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OCEANOGRAPHIC DATA BANK SURVEY.(U)

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ABSTRACT

This report summarizes the findings of an Oceanographic Data Bank Survey, performed by Calspan Corporation, formerly Cornell Aeronautical Laboratory, for the Office of Naval Research (ONR), Long Range Acoustic Propagation Program (LRAPP). The survey was conducted in order to eliminate duplication of data base development and to aid the Data Base Manager in establishing the data banks for the Acoustic Environmental Support Detachment (AESD). ~~of ONR.~~

A key finding is that no one data bank exists that will satisfy the total needs of AESD. Data bases available from the National Oceanographic Data Center (NODC), Fleet Numerical Neather Central (FNWC) and the U. S. Naval Oceanographic Office (NAVOCEANO) will be required to construct the initial AESD environmental data banks. The Scripps Institution of Oceanography (Scripps) and the Gulf Universities Research Consortium (GURC) have data that either is not useful to AESD or is duplicated at NODC, FNWC, or NAVOCEANO.

None of the agencies surveyed has achieved an interactive graphics capability that approaches the state of development that AESD will probably require.

Some sources of data AESD might use to construct its environmental data banks are presented, and the advantages and disadvantages of each source are discussed. Methods of structuring the AESD environmental data banks for both near term and longer range use are discussed.

TABLE OF CONTENTS

I. SUMMARY

Table I summarizes some finding of an oceanographic data bank survey conducted by Calspan Corporation for the Long Range Acoustic Propagation Project of ONR. This survey was undertaken to aid the Acoustical Environmental Support Detachment of ONR in establishing the environmental data banks required for its operations. The possible contributions to AESD, as shown in Table I, are data from three organizations and a limited amount of software support from FNWC.

The initial AESD modeling efforts are being devoted to acoustic propagation programs for long range passive detection systems. These models require bottom profile and velocity of sound versus depth between the source of sound and the receiver. Accordingly, the most important data banks to AESD's immediate needs are those containing bathymetric data (bottom depth versus location in the world) and velocity of sound versus depth versus location in the world and month. At the present time there is no bathymetric data bank in digital form that will satisfy the AESD needs. However digitization methodology is being developed by Calspan to digitize the NAVOCEANO bottom profile charts. Bottom profile inputs to the prediction programs will have to be extracted by hand from the profile charts until the digitized version becomes available.

Since velocity of sound measurements are scarce, an alternative solution to a velocity of sound data bank is to calculate the velocity of sound from a data bank containing temperature and salinity versus depth versus location and month using Wilson's formula[1].

NODC, NAVOCEANO, and FNWC all have data banks containing temperature, salinity, and sound velocity (calculated using Wilson's formula) versus depth versus location and month. The NODC Station File, which is the primary

(1) Wilson, W. D.: Speed of Sound in Sea Water as a Function of Temperature, Pressure, and Salinity., J. Acoust., Soc. Am., Vol. 32, pg.641 (1960)

Table 1

OCEANOGRAPHIC DATA BANK SURVEY SUMMA

AGENCY	AGENCY GOALS	SIZE OF ACTIVITY	TYPES OF DATA	COMPUTER FAC
NODC NATIONAL OCEANOGRAPHIC DATA CENTER	TO SUPPLY OCEANO-GRAPHIC DATA TO SECONDARY USERS	130 PEOPLE 60% PROFESSIONAL 40% NON PROFESSIONAL	STATION DATA I & II FILES DIGITIZED BT DATA DIGITIZED XBT DATA VARIOUS OTHER DATA NOT OF INTEREST TO AESD	IBM 360-40 384 K CORE 8 IBM 2314 DISKS 5-9 TRACK TAPE D 1-7 TRACK TAPE D 2-IBM 2260 CRT TE CALCOMP 760 PLO
NAVOCEANO U.S. NAVAL OCEANOGRAPHIC OFFICE	SUPPORT NAVY PROJECTS; ACOUSTIC AND SYSTEMS	1400 TOTAL PERSONNEL 10% DATA BANK & COMPUTER OPERATIONS	OCEAN STATION FILE BT FILE OCEAN CURRENTS TRANSMISSION LOSS VOLUME REVERBERATION BOTTOM LOSS BATHYMETRIC CHARTS AMBIENT NOISE FALSE TARGET	UNIVAC 1108 196 K CORE 6 UNIVAC 432 DRU 12-7 TRACK TAPE 2 CALCOMP PLOTT 3 REMOTE TERMI 6 AMPEX DS 8430
GURC GULF UNIVERSITIES RESEARCH CONSORTIUM	ENVIRONMENTAL MODELING AND ENVIRONMENTAL IMPACT STATEMENTS	10 FULL TIME GURC -- VARYING UNIVERSITY PERSONNEL	BIOLOGICAL DATA AND BT'S FROM GULF OF MEXICO AND U.S. ATLANTIC COAST	RENTS TIME ON NA UNIVAC 1108
SCRIPPS SCRIPPS INSTITUTION OF OCEANOGRAPHY	DEVELOP HISTORICAL CLIMATOLOGY 0-400 FOOT DEPTH. DIGITIZE BT'S	1-½ FULL TIME PROFESSIONALS 9 TECHNICIANS	BT'S DIGITIZED FOR NODC	USES FNWC CDC-6
FNWC FLEET NUMERICAL WEATHER CENTRAL	WEATHER AND SONAR PREDICTIONS FOR FLEET SUPPORT DIGITIZE XBT'S	170 TOTAL PERSONNEL 150 IN METEOROLOGY 20 IN OCEANOLOGY	OPERATIONAL HISTORICAL CLIMATOLOGY. DEVELOPMENTAL HISTORICAL CLIMATOLOGY. "QUALIFIED RAW DATA".	2 CDC 6500 350 K CORE 1 MILLION EXTEN VARIAN ELECTRO PLOTTER 10-7 TRACK TAPE 1 DISK

Table 1

ANOGRAPHIC DATA BANK SURVEY SUMMARY

TYPES OF DATA	COMPUTER FACILITIES	DATA MANAGEMENT TECHNIQUES	POSSIBLE CONTRIBUTION TO AESD
STATION DATA I & II FILES DIGITIZED BT DATA DIGITIZED XBT DATA VARIOUS OTHER DATA NOT OF INTEREST TO AESD	IBM 360-40 384 K CORE 8 IBM 2314 DISKS 5-9 TRACK TAPE DRIVES 1-7 TRACK TAPE DRIVES 2-IBM 2260 CRT TERM CALCOMP 760 PLOTTER	SEQUENTIAL TAPE FILES IN CHARACTER FORMAT. RETRIEVAL BY SEQUENTIAL INDEX SEARCH. VALIDATION BY COMPARISON WITH PHYSICAL CONSTRAINTS. ON LINE CRT GRAPHICS AND OFF LINE PLOTTING.	STATION DATA FILE DIGITIZED BT DATA DIGITIZED XBT DATA
OCEAN STATION FILE BT FILE OCEAN CURRENTS TRANSMISSION LOSS VOLUME REVERBERATION BOTTOM LOSS BATHYMETRIC CHARTS AMBIENT NOISE FALSE TARGET	UNIVAC 1108 196 K CORE 6 UNIVAC 432 DRUMS 12-7 TRACK TAPE DRIVES 2 CALCOMP PLOTTERS 3 REMOTE TERMINALS 6 AMPEX DS 8430 DISKS	SEQUENTIAL TAPE AND DRUM FILES IN BINARY FORMAT. RETRIEVAL BY MODIFIED SEQUENTIAL SEARCH. VALIDATION SAME AS NODC. OFF LINE PLOTTING	OCEAN STATION FILE BT FILE OCEAN CURRENTS BOTTOM LOSS BATHYMETRIC CHARTS AMBIENT NOISE
BIOLOGICAL DATA AND BT'S FROM GULF OF MEXICO AND U.S. ATLANTIC COAST	RENTS TIME ON NASA UNIVAC 1108	ENVIR AND TG4DA PROGRAMS ARE SOPHISTICATED WITH CERTAIN STORAGE, RETRIEVAL AND ANALYSIS CAPABILITIES	---
BT'S DIGITIZED FOR NODC	USES FNWC CDC-6500	SEQUENTIAL TAPE FILES IN BINARY FORM. EXTENSIVE EFFORTS IN GRAPHICAL DATA DISPLAY	---
OPERATIONAL HISTORICAL CLIMATOLOGY. DEVELOPMENTAL HISTORICAL CLIMATOLOGY. "QUALIFIED RAW DATA".	2 CDC 6500 350 K CORE 1 MILLION EXTENDED CORE VARIAN ELECTROSTATIC PLOTTER 10-7 TRACK TAPE DRIVE 1 DISK	SEQUENTIAL TAPE AND DISK FILES. ANALYSIS TECHNIQUES INCLUDE MERGING CURRENT AND HISTORICAL CLIMATOLOGICAL DATA AND OBJECTIVE ANALYSIS FOR PREDICTION.	ALL ITEMS IN "TYPES OF DATA" COLUMN. OBJECTIVE ANALYSIS PROGRAM. SOFTWARE THAT GOES WITH DATA.

2

1

repository for this information, is periodically obtained to update the station files maintained by NAVOCEANO and FNWC and additionally has served as a partial building block for the FNWC historical climatology file.

The NAVOCEANO station file contains the same temperature and salinity information as did the NODC station file as of December 1971. However, instead of writing the information on tape in character format, the file was reformatted into a binary compressed format, referred to as the Yergen format at NAVOCEANO. This binary compressed format has allowed NAVOCEANO to get the entire station date file on four reels of magnetic tape compared to approximately twenty reels when received from NODC.

NAVOCEANO also has a classified data file of physical properties which include data from the LRAPP and CAESAR surveys.

The FNWC operational historical climatology by month contains values for temperature and salinity versus depth at the grid points of a 63 X 63 matrix overlaying a polar stereographic projection (see page 25). Values for locations other than the grid points are calculated using an interpolation algorithm. The temperature values versus depth for each grid point were derived using an objective analysis method and data averaged from NODC station data, NODC BT and XBT and from the classified BT and XBT data available to FNWC. The salinity values used by FNWC were derived from two atlases.

If AESD were to obtain the FNWC operational historical climatological data, it would give them an operational data bank of temperature and salinity that allows the extraction of sound velocity profiles along any great circle path in the northern hemisphere in the shortest time period. However, improvements to the FNWC operational historical climatology are being made (the FNWC development historical climatology) and AESD should keep apprised of the status of the improvements.

Because the salinity data used by FNWC was compiled from atlas information, AESD may want to develop a new salinity data bank (perhaps with statistical information as well as averages) from the NODC station file.

Of the agencies surveyed, only NODC is using interactive graphics. Their utilization of this tool that allows the user to interact with the data bank has been limited to display of summary information from the station data file contained in a small on line file. NAVOCEANO has developed the capability to use interactive graphic techniques but funding restrictions presently restrict its utilization.

Scripps and GURC have data that is either not needed by AESD or is duplicated at either NODC, FNWC or NAVOCEANO.

II. INTRODUCTION

The Acoustic Environmental Support Detachment (AESD) of ONR was established to develop uniform, technically consistent, undersea acoustic environmental prediction models; and information for use by all levels of command for strategic planning, intelligence, tactical, operational, and system evaluation/design purposes in ocean areas of selected critical importance. The technical requirements to be satisfied by AESD include the following tasks:

1. The development, validation, maintenance, and improvement of standard Navy models of transmission loss, reverberation, and ambient noise.

2. The development, validation, documentation, and maintenance of combinations and/or subsets of the functional models for application to specific systems and for fleet support.

3. The preparation and maintenance of a digital data bank of measured acoustic data and its associated environmental data with high speed information retrieval capability and real time access to major Navy laboratories, analytical activities, and the Naval ASW Data Center (FADAP Project).

4. The design, preparation, and initial maintenance of a data bank of environmental physical variables properly formatted and retrievable as necessary for input to acoustic models.

5. The preparation and maintenance of an AESD library, including acoustic prediction as required for evaluation

of weapon systems and weapon systems concepts.

6. The provision of special acoustic computational support for operational commanders including the provision of assistance as necessary to execute models at other commands.

In order to avoid a duplication of effort between existing oceanographic data banks and the proposed AESD environmental data banks (AESD task #4), Calspan Corporation of Buffalo, N. Y. was contracted to survey existing data banks that might satisfy AESD needs. Data required as input to predictive acoustic models include bathymetry, temperature, salinity, wind speed, wave height, acoustic reflectivity and scattering strengths of the ocean bottom and surface.

Because they have banks with some of the above data, the following organizations were included in the survey:

1. National Oceanographic Data Center, Washington D.C.
2. U.S. Naval Oceanographic Office, Washington, D.C.
3. Gulf Universities Research Consortium, Galveston, Texas
4. Scripps Institution of Oceanography, LaJolla, California
5. Fleet Numerical Weather Central, Monterey California

The survey included the following items:

1. Purpose of the bank
2. Data types
3. Form of input
4. Form of output
5. Techniques for
    a. storing
    b. retrieving
    c. qualifying
    d. updating
    e. displaying
6. Computer facilities used including hardware and software

7. Number of people devoted to the activity
8. Whom the bank serves

The survey was conducted by visiting each of the five organizations and discussing the above items with members of each organization's technical and administrative staff. Some descriptive literature was also obtained from each organization.

Section III of this report summarizes the findings of the survey from the visits to each organization. Section III contains some source of data that AESD might use to construct and structure its environmental data banks. Appendices are included that show the tape formats used by NODC and FNWC for various types of data. These formats, which define for AESD the data as they exist at NODC and FNWC, will be required if AESD acquires any of these data.

III. SURVEY SUMMARIES

This section of the report contains summaries of the information obtained from the visits to the five organizations.

A. National Oceanographic Data Center (NODC)

The NODC was established in December 1960 to acquire and disseminate oceanographic data. Originally NODC was administered by the U.S. Naval Oceanographic Office but it was transferred to the U.S. Department of Commerce in October 1970. The purpose of the NODC is to acquire oceanographic data and to provide it for use by secondary users. In fiscal year 1972 (ended June 30, 1972) the percentage of requests for data from various groups of users was as follows:

Academic community		22-1/2%
Government		34%
DOD	14%	
Commerce	10%	
Others	10%	
Industry		12%
General Public		22-1/2%
Foreign		9%
Total		100%

The volume of data supplied to the various users does not have the same distribution as does the number of requests. For example even though the general public made 22-1/2% of the total number of requests for data, these requests were often less sophisticated than the requests made by other users of oceanographic data.

NODC is an organization of approximately 130 people headed by Mr. Robert V. Ochinero. It is organized into the following four divisions:

Operations Division performs the functions of data acquisition, records control, processing, and quality control.

Services Division provides oceanographic data, summaries, information, publications, archiving and analysis services both nationally and internationally to Federal, State, scientific organizations, industry, and the public.

Development Division develops and implements data and information systems from initial concept to operational status, formulates data base configurations, and develops data products to improve services.

Computer Systems Division provides computer-related services, such as mathematical analysis, system analyses, and programming for assistance in the establishment, maintenance and retrieval from the national marine data base and information systems.

Approximately 60% of the NODC personnel are professionals which include oceanographers, mathematicians, and computer specialists with the remaining 40% being non professionals.

NODC's Operations Division acquires data from universities with marine science programs, the U.S. Navy, the National Oceanographic and Atmospheric Administration, National Science Foundation through its funding of the International Decade of Ocean Exploration, oil companies, U.S. Army Corps of Engineers, the U.S. Coast Guard and through international bi-lateral agreements with other countries and the World Data Center System for the exchange of data.

The data bases maintained by NODC and their volumes are shown below:

Station data geosort (as of 31 March 1972)	441,597	stations
*BT data digitized geosort (as of 30 June 1972)	699,496	observations
**XBT data digitized geosort (as of 30 April 972)	37,123	observations
BT analog prints	820,000	observations
Biological data digital	13,000	stations
Biological papers stored for retrieval	12,500	
Geology information system	32,000	sample locations
Surface drift data	3,375,000	observations
Bottom photograph station data	3,500	camera positions

In addition to the above data bases NODC is starting to acquire a few STD's (salinity and temperature, depth measurements.)

The Station data geosort file contains physical, chemical and meteorological data from an oceanographic station in addition to data that locate the station in time and space. Appendix V-1 shows the tape format of a record for an oceanographic station. Note that each record consistes of one Master record and several Detail records. The Master record contains information such as Originator's Nationality, Ship Name, Location by Latitude and Longitude, Marsden Square, Year, Month, Day, Time of Day, and various weather observations. The Detail records repeat some of the information from the Master record (first 24 bytes of the record) and add information such as temperature, salinity and chemistry data at each of several depths. There are three types of Detail records - Observed, Literature, and Standard Depth records. The Observed Detail records are the actual observations as reported by the observer. The Literature Detail records differ from the Observed Detail records in that they may have been values interpolated by the observer or by another user of the original data. The Standard Depth Detail records contain the various

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* Bathythermograph
** Expendable Bathythermograph

data interpolated to the standard depths that NODC uses. The 34 standard NODC depths are 0, 10, 20, 30, 50, 75, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1750, 2000, 2500, 3000, 4000, 5000, 6000, 7000, 8000, and 9000 meters. Other codes and standards used by NODC are described in its Publication M-2 titled "Processing Physical and Chemical Data from Oceanographic Stations". Each record for a particular oceanographic station contains both Standard Depth Detail Cards and Observed or Literature Detail Cards. If the Observed depths are the same as the Standard Depths, there are two depth records that contain duplicate information (except for code that describes type of detail card).

The ocean station file as maintained at NODC is recorded on 9 track magnetic tape packed at 1600 characters per inch. Each physical record on tape consists of 40 master or detail records (master and detail records are both 83 bytes long). At present the station data is contained on about 30 reels of 9 track magnetic tape. In addition to 9 track 1600 bpi, odd parity, EBCDC tapes, NODC can also furnish the station data on 7 track tape, 556 or 800 bpi, BCD, even parity or 9-track 800 bpi, EBCDIC, odd parity.

The ocean station file is written on tape in the order of increasing Marsden square numbers. Within the same Marsden square, the records containing the one degree square with the smallest identifying number come first. The ocean station file is blocked 40 records to a block-- hence each record is 3320 bytes long (40 x 83).

Appendix V-2 is the current format of the oceanographic station file--Station Data II. It contains the same basic information that the original station file contains but in slightly different format. Data from each ocean station consists of Master and Detail information as in the original Station Data file. However, the information from the Master record that was repeated in the Detail record has been deleted and certain precision indicators have been added to the temperature, salinity and chemistry fields. The Master record is 160 bytes long whereas the two types of detail information - Observed depth and Standard depth - are 80 bytes long. The tape format is blocked in

variable record length with a maximum length of 5300 bytes. The Station Data II file uses the modified Canadian system of coding position on the earth. The modified Canadian square system is shown overlaying the Marsden Square system in Appendix V-3.

The BT data originally comes to NODC as an analog chart, and must be converted to digital format for computer storage. At the present time BT data is digitized for NODC by Scripps Institution of Oceanography. The variable length BT record format is shown in Appendix V-4.

Each record begins with a 112 byte record header containing location, ship, date and various other codes. The fixed length header portion of the record is followed by a variable number (maximum = 100) of two byte words that indicate the temperature measured by the bathythermograph instrument at five meter intervals. The BT file used at NODC is contained on four 9 track, 1600 bpi, 324 VB, Packed Decimal and EBCDIC, odd parity tapes. The physical records are variable length blocks with a maximum length of 3520 bytes.

The BT data can also be supplied in the following magnetic tape formats:

9 track, 800 bpi, 324 VB, Packed Decimal and EBCDIC, odd parity

or

7 track (BCD), even parity, 80 characters, 556 or 800 bpi

or

9 track (EBCDIC), odd parity, 80 characters, 800 or 1600 bpi

XBT data also come to NODC in analog form and are digitized for NODC by Vitro Laboratories. The XBT tape formats (9 track and 7 track) are shown in Appendix V-5 . The records are of variable length (maximum block length = 608 bytes, maximum logical record length = 604 bytes) containing 80 bytes of header information followed by temperature, depth groups. The temperature and depth data is recorded at significant flexure points in the temperature - not at standard depths. At the present time NODC has just started on its second tape containing XBT data.

The other NODC data bases are not of interest to AESD and are not described here. (Although Surface Current data is of interest to AESD, the NODC data contain ship drift observations only through the year 1945 and are therefore not of practical interest.)

The NODC computer facilities consist of an IBM 360-40 computer with 384 K bytes of core memory, eight IBM 2314 Direct Access Storage Disks, five 9 track tape drives, one 7 track tape drive, two IBM 2260 alphanumeric CRT terminals and one IBM 2250 Graphics CRT terminal. The facility also includes an IBM 1403 line printer, a card reader and punch and a CALCOMP 760 off line plotter. NODC is installing an IBM 2701 data communications set to allow the National Science Foundation to access a special management information system data bank that was specifically designed for the management of IDOE information from a remote terminal.

The IBM 2260 alphanumeric terminal is used in conjunction with the NODC Accession Information Production System to keep track of the status of various jobs in the NODC system. It is also used with a Parameter Inventory Display system which allows the user to obtain quick low cost inventory summary information concerning the NODC bathythermograph and oceanographic station data files. For the latter the user specifies a geographical area, and within that area, chemistry, depth, year, country, cruise and consecutive number parameters. The program responds with a display of the number of records by month, standard seasons, and all months.

Planned changes to the NODC computer facilities include sharing an IBM 360-65 with two other government agencies starting in March or April, 1973.

In addition to magnetic tape, data from NODC are available as computer listings, some specialized plotted data and computer cards.

The primary technique for storing data is on 9 track magnetic tape. Retrieval of any data item is through a sequential search of the magnetic tapes for key word information. The key words on which information can be retrieved are the location, ship, and date codes contained in the various records.

Data quality control ranges from "very good to very poor, being primarily a function of the type of data," in the words of Mr. Ochinero at NODC. For station data and bathythermograph data (mechanical and expendable) quality control falls into the very good and good categories, respectively. The primary checks of quality control are internal consistency checks (such as speed of advance, changes in hemisphere, checking the visibility code versus time of day, etc.) and the oceanographic plausibility of the data.

New data is added to the existing data banks quarterly. The method used is simply to order the new records in the order that they will occur on the tapes and then merge the new records with the old tapes using standard tape merge techniques.

Most NODC software is written in the Fortran and PL-1 languages with a few routines written in assembly language of the IBM 360 computer.

Address of NODC is:

U.S. Department of Commerce
National Oceanic and Stmospheric Administration
National Oceanographic Data Center
Rockville, Maryland 20852

To obtain data from NODC, contact Mr. Albert Bargeski at the above address or phone (202) 426-9044. Mr. John Chakalis, Director of the Computer Systems Division, may be contacted at (202) 426-9054 for more information about data formats or computer services.

B. U.S. Naval Oceanographic Office (NAVOCEANO)

NAVOCEANO is an organization of about 1400 people whose purpose is to support Navy programs. Of the 1400 people approximately 10% are involved in computer and/or data bank operations. The data banks at NAVOCEANO include

1. Physical Properties of the Ocean
    a. Ocean Station File
    b. Bathythermograph (BT) Profiles
    c. Sea Surface Temperature
2. Ocean Currents
    a. Surface Current File
    b. Subsurface Current File
3. Sediment Properties
4. Bathymetry
    a. Digital Bathymetric Data Base
    b. DOD Bathymetric Library
5. Magnetics
6. Acoustic Data Files
    a. Transmission Loss
    b. Volume Reverberation
    c. Bottom Loss
    d. Ambient Noise
    e. False Target Data
7. Bioacoustic File
8. Climatology File
    a. Summary Climatology File
    b. Basic Climatology File
9. Seismic Reflection Data
10. Ice Data File
    a. Top roughness
    b. Bottom Ice roughness
    c. Multiplatform Ice File
    d. Local Ice File

Detailed information about the volmes of data, degree of automation, and contents of each file can be found in Appendix V-6.

The Ocean Station File, Sediment Properties File and Surface Current File are considered fully automated. The Ocean Station resides on 4 reels of 7 track magnetic tape packed at 556 bpi. It contains the NODC station file in Yergen compressed format as of December 1971 and features such things as an index that gives block number versus Marsden square number for quick retrieval. This feature allows the computer to skip over blocks of information after reading the header block number to get to the correct block. The retrieval program is written in assembler language and the subroutine to unpack the data is written in Fortran.

The comparison time for unpacking ocean station data for UNIVAC 1108 arithmetic processing is

a) Unpack all data:
 "Yergen File," 6000 stations per CPU minute
 NODC File, 1500 stations per CPU minute

b) Unpack station identifiers only (place, time, country code, reference numbers, date presence omdocatprs):
 "Yergen File," 50,000 stations per CPU minute
 NODC File, 1,500 stations per CPU minute

The Ocean Station data are being resorted to correspond to ocean basins rather than being sorted by Marsden square. Temperature and salinity information versus depth and location on the earth is extracted from the Ocean Station file to be used to calculate sound velocity profiles. These sound velocity profiles are used as inputs to acoustic propagation programs.

The NAVOCEANO Bottom Loss file was described as the "most comprehensive bottom loss" file the Navy has. It contains bottom loss vs. grazing angle information in the frequency range from 500 Hz - 12 KHz from 1500 Northern Hemisphere stations.

The Bathymetry and Ambient Noise files are being developed by NAVOCEANO personnel who are funded by LRAPP to provide technical support to AESD. The other NAVOCEANO data banks are probably not of interest to AESD.

The NAVOCEANO computer facilities consists of a Univac 1108 computer with 196 K of 36 bit core memory words, six AMPEX DS 8430 disks, six Univac 432 drums, twelve 7 track Univac tape units, two off line CALCOMP plotters, card readers, two high speed printers and one medium speed printer for high quality printed output. The Univac 1108 has three remote batch terminals connected to it using voice grade telephone lines for transmission.

At present NAVOCEANO uses sequential files - either tape or disk. Eventually these files will be replaced with Random Access Files but no date for doing so was given. Additions and updates being considered for the computer system include addition of a high speed electrostatic printer plotter, and addition of an optical character recognition system.

In 1969 NAVOCEANO developed an interactive geophysical data retrieval and display system as well as methods for the visual display of oceanographic and sound velocity profile data. The system was designed to run on the IBM 360-95 computer located at NASA's Goddard Space Center in Greenbelt, Maryland. The system utilizes 1600 BPI tapes, 2315 disk units and an IBM 2250 250 Mod III vector generating scope with keyboard, function keys and light pen. Funding restrictions presently restrict its utilization and preclude the work required to reprogram the system on NAVOCEANO's Univac 1108. The NAVOCEANO interactive graphic system attributes are listed in Appendix V-7.

Questions concerning NAVOCEANO's data holdings can be directed to Mr. Warren Randlett at (202) 763-1255 and those concerning the computer operations to Mr. O.W. "Bill" Cairns at (202) 763-1382.

C. Gulf Universities Research Consortium (GURC)

GURC is a non profit corporation, chartered under the laws of the State of Texas. Its charter enables it "to encourage, foster and promote advance research and development and education in science and engineering; and to promote, initiate, support and accomplish cooperative research, development and educational programs in these fields of public interest." GURC consists of approximately 10 full time people with a varying number of personnel available from the university members of the Consortium.

Participants in the Consortium are classified into three categories:

1. Trustee Institutions - at present 19 universities which have major graduate programs in environmental desciplines.
2. Research Associates - three non profit research institutes.
3. Affiliate - primarily oil companies.

GURC has focused its attention on research programs relating to the ecology and environment of the Gulf of Mexico with some similar work also being performed on the U.S. Atlantic coast.

To this end, the data that GURC has collected consists of various biological indicators in addition to bathythermograph data in the Gulf and Atlantic coastal regions. These data are used as input to environmental and ecological predictive models. The output of this modeling effort is intended to provide information that will allow GURC to make "environment impact statements" - i.e., given a proposed project, be it a new community near the Gulf coast or a dozen new oil wells in the Gulf, the information from the simulation gives information about the effect of the project on the environment.

In order to interface to the various modeling programs, GURC has developed a number of computer programs. The most important program is titled "ENVIR". It is an "Environmental Information Retrieval" program. The ENVIR program receives environmental data in card image form and automatically compresses the data onto a binary tape. Since many of the biological and environmental descriptors for the data can be very long, the program is able to compress the data by using a code for the descriptors. Typical compression ratios quoted for the data being handled range from 20:1 to 100:1. After the data have been compressed, any item of information that satisfies a given description is retrieved by searching the coded bits that represent the information in core memory. Since the search is done in core all searches take the same amount of computer time.

Another program that has been developed by GURC is titled TG4DA, a program that performs objective analysis on a set of observations. Objective analysis is the process by which a set of synoptic (i.e., simultaneous) randomly located observations is converted into an array of evenly spaced grid point values, suitable for further processing by a mathematical model or by a contouring program. This is a common operation in meteorology, where it is executed in two dimensions, resulting in a map of an atmospheric quantity at a given time and altitude.

TG4DA is a technique of objective analysis by which the fields are defined and stored as four-dimensional arrays with the two very important advantages that the inherent space-time continuity of the fields is embodied in the mathematical definition of the output arrays, and that the program interpolates in time and height (or depth) as well as in the other dimensions. It is, therefore, no longer limited to the use of observations taken at standard times or levels but employs all data gathered anywhere in the x-y-z-t domain explored.

Although the primary function of TG4DA is computational, an isopleth generator developed in Miami by the National Hurricane Center, Program ECHKON,

has been interfaced to it and provides contoured cross sections of the analyzed fields on graphic output devices such as paper plotters or CRT displays.

GURC does not have its own computer facility. It rents time on the NASA Univac 1108 at the Mississippi Test Facility, Bay St. Louis.

Further information about GURC can be obtained by contacting:

Mr. Ian A. Miller
GURC
NASA/MTF
Bay St. Louis, Mississippi
Phone: (601) 688-3760

D. Scripps Institution of Oceanography (Scripps)

The survey of oceanographic data bank operations at Scripps was limited to the work being done by Mrs. Margaret Robinson and does not reflect the full breadth of work being done at the institution. The purpose of her work is to develop a mean climatology of the ocean based on existing data. The project has been ongoing since the fifties when the calculations were done by hand. In 1960 a computer was used for the first time to help with the calculations. In 1965 Fleet Numerical Weather Central (FNWC) began funding the effort so that the results could be used in sonar prediction programs.

The mean temperature by month of each 1° square in all oceans north of 5° south at 0, 100, 200, 300, 400 foot depths was first completed in 1965 with final revisions in 1972. Recent effort has been directed towards calculating, interpolating and editing the annual (all data) fields by 1° square of temperature at standard hydrocast levels 150 meters to the bottom and annual (all data) mean fields of salinity surface to bottom from NODC station data as of 1969. Contour charts of the shallow-temperatures have been completed and preliminary contour charts of the deep data fields (annual temperature and annual salinity) are in hand with the editing being performed to produce the final charts.

The monthly shallow temperature data, annual deep temperature data and annual salinity data will be assembled on master tapes that will give temperature and salinity by 1° square versus month. The master tapes will also include sound velocity values, calculated using Wilson's formula, from surface to bottom. This work gives values for temperature and salinity in ocean areas where there are no measurements by using interpolation and extrapolation procedures based on the available surrounding data.

At the present time there are about 1-1/2 people full time on the project. Recent work showing some temperature contours of the ocean by month in color were very impressive.

The calculations needed to contour the ocean temperatures are performed on the FNWC CDC 6500 computer. The contour charts are produced on the FNWC Varian electrostatic plotter. The data tapes are kept at FNWC.

Another related ongoing project at Scripps under the direction of Mrs. Robinson is the digitizing of mechanical BT's. Approximately 9 full time technicians work on this project.

Mrs. Robinson is due to retire from Scripps in October 1973. The funding for the mean climatology project from FNWC runs out soon. Contact with Mrs. Robinson can be made at (714) 453-2000. X1135.

E. Fleet Numerical Weather Central (FNWC)

The objective of FNWC is to support Navy fleet operations by providing predictions of weather conditions and sonar performance in the oceans of the world. The sonar prediction capability is presently restricted to the northern hemisphere primarily because of a lack of data in the sourthern hemisphere.

The data banks of meteorological and oceanographic climatological data that have been developed are used as input to the predictive programs that FNWC uses. The atmospheric predictions are derived from data received from approximately 5000 weather stations twice daily at the synoptic times of 1200 and 2400 hours. Only about 130 BT's per day are received by FNWC and the predictions for oceanographic conditions (temperature and salinity versus depth) are based partly on the scarce current data (BT's up to 72 hours old) and partly on historical climatological data stored on computer disk files.

The sonar predictions being made at FNWC include the ASRAP II, SHARPS II, and SUBRAP models for VP aircraft, ships and helicipters, and submarines, respectively. The output of these programs is a prediction of the 50% probability of detection range for the various passive and active sonars deployed by each platform.

Each sonar prediction model uses the temperature and salinity data to calculate the sound speed vs. depth profiles as input to the acoustic models. The standard depths used by FNWC for temperature are 0, 100, 200, 300, 400, 600, 800, and 1200 feet; 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000, 4000, and 5000 meters.

Salinity values are stored for 0, 25, 50, 100, 150, 200, 400, 600, 800, 1000, 1500, 2000, 2500, 3000, 4000, and 5000 meters.

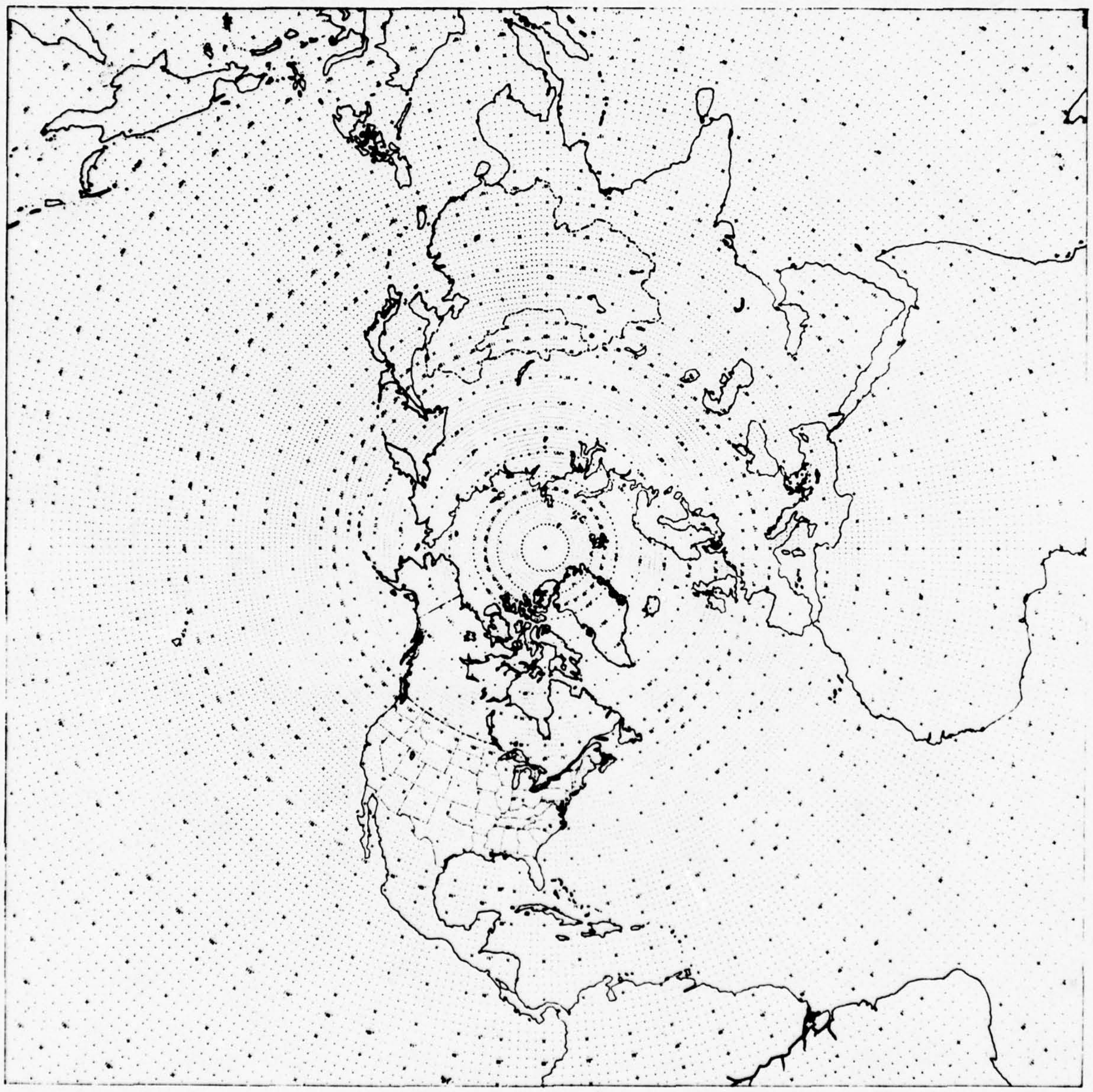
The current month's historical climatological data is stored on computer disk for quick access. The historical climatological data for all twelve months is stored on 7 track magnetic tape.

Figure 1 shows the polar stereographic projection of the Northern hemisphere used by FNWC. Atmospheric and oceanic climatological data at the 3969 grid points defined by a uniformly spaced 63 x 63 grid on this projection are stored. There are 19 individual files for each of the 3969 temperatures at each of the 19 standard temperature depths and 16 files for each of the 3969 salinity values of each of the 16 standard salinity depths. Each file stored on disk is 3989 words long - 20 words of header information followed by 3969 words of data. The format of the disk file along with the various codes for each file is given in Appendix V-8.

By contrast the tape files use only 16 bits to represent a data value and hence the 3969 - 60 bit words are compressed into 1052 words on tape or 10520 characters (6 bits + 1 parity bit/character, and 10 characters/ 60 bit word).

The exact tape format for the historical temperature and salinity files has not been obtained from FNWC. However, it has been learned that a special routine has been developed to read the files since the standard CDC tape reading format is restricted to files 512 characters long. To read in, unpack, and "float" field with Fortran the routine used is RDMSTF and to write a field from core to tape uses the routine WRMSTF.

The operational historical climatology described above has been used at FNWC since June, 1971. The historical temperature file was created at each of the 3969 grid points by averaging the available temperature by month at each standard depth, then applying the techniques of objective analysis to obtain the values at the grid points. The data used to derive the average temperatures by month included NODC station data, BT's and XBT's available at FNWC. The values for the temperature at each standard depth for



SCALE: 1:120,000,000 FLEET NUMERICAL WEATHER FACILITY, MONTEREY, CALIFORNIA CHART NO. 12-A

Figure 1

those grid points that occur on land were "hand smoothed" in order to give realistic values near land/sea interfaces.

The historical salinity field was put together in 1966 or 67 from atlas information. In order to find the values of temperature and salinity at an arbitrary point (latitude and longitude) the point is first transformed to a point in the polar sterographic projection plane. Then double quadratic Bessel interpolation is applied using the 16 surrounding grid points. By repeatedly applying this technique the velocity of sound along any track in the northern hemisphere may be calculated using Wilson's formula and the temperature and salinity values versus depth. The present historical climatology represents fairly well the temperature and salinity values in those parts of the ocean where there is not much variability. However, in areas such as the Gulf Stream it does not do well.

In addition to the operational climatology by month that FNWC uses for sonar prediction, the FNWC development division has just completed a project that gives average temperature and statistical information (max, min, standard deviation and number of observations) at each of the 19 standard depths used by FNWC by 2° square. Each record is 21 words long. The record format is shown in Appendix V-9.

It is anticipated that this new climatology with average values and statistical information will replace the present operational climatology. The time frame for this replacement is not clear. This new climatology with statistics is expected to help solve the merge problem between the deep climatology ($>$ 400 meters) and the synoptic XBT data.

In addition to the final file with the average temperatures and statistical information, FNWC has one tape for each month that contains all of the "qualified raw data" that went into making up the statistical file. The data that was use for the "unqualified raw data" includes NODC station data, BT's and XBT's. The quality control methods used to qualify data and

other aspects of the project are described in the FNWC documentation which is attached as Appendix V-10.

FNWC also has bathymetric data banks for the Pacific Ocean and Mediterranean Sea. For the Pacific Ocean the maximum and minimum depth is given by code for each 20 minute square. The depth codes are in granularities of 500 meters and no information about bottom slope may be obtained from this data. The Mediterranean is done in a similar fashion except that maximum and minimum depths in units of tens of fathoms are given for each 10 minute square.

The computer facilities used by FNWC include 2 CDC 6500 computers. each with 350 K words of core storage, 1 million words of extended core storage, card reader, 2 printers, a Varian electrostatic plotter and 2 Calcomp plotters. Also included in the peripherals are ten 7 track tape drives and a disk file (not the removable disk pack but the large system file type). Programming is done in the Fortran language. Software and hardware interface between the Varian electrostatic plotter were developed by FNWC personnel.

FNWC is an organization of about 170 people. Approximately 15-20 people are devoted to oceanography - total of both operational and development people.

IV. CONCLUSIONS

There are several important available sources of data that AESD could use to build a environmental data bank. They are:

1. NODC station data, BT, and XBT data
2. NAVOCEANO station data
3. FNWC operational historical climatology with associated software
4. FNWC developmental historical climatology
5. FNWC "qualified raw data" for 4 above. 12 data tapes - one for each month.

The NODC station data would give AESD a bank of temperature and salinity versus depth versus observation date. The BT and XBT data would supplement the temperature versus depth data available in the station data file and would give more observations to average over, especially for depths less than 1200 feet (BT measurements are limited to 900 feet and XBT measurements are limited to 1200 feet). The NODC station data, BT data and XBT data are all in different formats. Hence, the files are not easily merged. In addition the station data file contains much redundant information and data not applicable to the AESD needs (particularly chemical information stored in each detail record).

The NAVOCEANO station file contains the same temperature and salinity information as did the NODC station file as of December, 1971. However, the redundant data (first 24 characters of each detail card) have been eliminated from the NODC station file by NAVOCEANO. In addition, the remaining data is written in a compressed binary format referred to as the Yergen format by NAVOCEANO. Since the data have been compressed from approximately 20 tapes to 4 tapes, retrieval of any one item is faster by NAVOCEANO than by NODC.

As shown above, FNWC has three types of data that could be used by AESD.

The FNWC operational historical climatological data bank and its associated software would give AESD the capability of extracting sound velocity profiles along any great circle path in the northern hemisphere. The FNWC operational formats store temperature at 19 standard depths and salinity at 16 depths at each of 3969 (63 x 63) grid points. Hence, the number of computer words required to store the FNWC historical climatology for any month is 138,805. The 138,805 words could be written in character format on a 7 track 556 bpi tape only 230 feet long. This is approximately one-tenth of a 2400 foot long magnetic tape and represents a tremendous reduction in volume of data stored compared to the NODC station file (30 tapes at 1600 bpi) or the NAVOCEANO station file (4 tapes). The possible disadvantages to the FNWC operational historical climatology are that the values have been smoothed too much in some parts of the ocean and that the salinity was derived from atlas information.

The data inherent to the FNWC developmental historical climatology (temperature versus depth only) contains mean temperatures, standard deviation, maximum terperature, minimum terperature and number of observations at each of the FNWC 19 standard depths and is indexed by location and month. These data, which average over station data, BT and XBT data at the 19 depths also greatly compresses the raw data but have not yet been formatted on the 63 x 63 grid system that allows for interpolation between grid point values. Hence, it would not be possible to calculate sound velocity versus depth along a great circle path using the data as presently structured.

When the data for the above developmental historical climatology is reformatted to the 63 x 63 grid system, it will have the advantages of the current operational historical climatology used by FNWC and will have the further advantages that

1. it will be more current
2. the temperature values will have an associated standard deviation and will thus allow for statistical analysis of propagation
3. it will contain data for the southern hemisphere as well as northern hemisphere.

One disadvantage is that it will require more storage than the present climatological data bank used by FNWC (average temperature, standard deviation and salinity compared to only average temperature and salinity).

The final item that FNWC has that may be of interest to AESD is the "qualified raw data" that went into the FNWC developmental historical climatological data bank described above. These data contain the qualified raw data sorted by month with the location and date identifiers still attached to the records. Hence it should be relatively easy to update this file as new data come in and to recalculate the historical averages, standard deviations, etc. contained in the FNWC developmental historical climatological data bank.

It is recommended that AESD acquire the FNWC operational historical climatological data bank with associated software to use as the initial AESD climatological data base. When data source #4 moves from developmental to operational status at FNWC, that data base should then be acquired by AESD.

AESD should also acquire the NODC station data and the FNWC "qualified raw data" (sources 1 and 5). These raw data can be used in a series of experiments to check the "reasonableness" of the predictions of temperature and salinity derived from data source # 3. In addition, AESD may want to undertake a project that compiles average salinity and its standard deviation using the NODC station data as input.

The ongoing co-operation between NAVOCEANO and AESD in the areas of digital bathymetry and ambient noise data banks is essential to the success of the AESD efforts. The NAVOCEANO data bank that relates bottom bounce loss versus grazing angle versus ocean area should also be acquired by AESD. Other NAVOCEANO data banks such as surface and subsurface currents may become valuable to AESD at a later stage in model development.

The AESD data banks should be stored on random access disk for quick access. If the data banks become too large to store all of the information on disk at one time then only the part being currently used should be stored on disk with the rest being stored on magnetic tape.

In order to obtain operational capability quickly, it will probably be necessary to structure the climatological, bathymetric, and ambient noise data banks as separate banks, each with its own associated retrieval and updating software. In the long run, it may be more desirable to have all of the data banks combined into one large bank with only one set of retrieval and update software. This final step will be useful if the propagation loss, reverberation and ambient noise model programs are combined into a larger operational program for system simulation.

Only NODC is using interactive graphics as a tool for the user in interacting with the data banks. The NODC capability is at present limited to interaction with a small file that summarizes by location the data items available in the larger banks. AESD should carefully consider the possible benefits that might accrue in having a fully developed capability to interact with its data banks.

In order to validate the "model ocean" described by the climatological, digital bathymetric and ambient noise data bases, two steps are involved. First the propagation models should be run against the environmental conditions present at the time of the acoustic measurements. When the model output is judged to accurately describe the experimental output, then

the model should be run with the input environmental data, including deviations from the mean, from the model ocean. If the output of this step compares favorably with the data from the experiments, then the "model ocean" is valid. If not, further refinements of the environmental data bases will be necessary in order to have the "model ocean" in conjunction with the propagation models make accurate acoustic predictions.

APPENDIX V-1

NODC STATION DATA FILE FORMAT

Magnetic Tape Record Layout - Station Data for IBM 360/40

Analyst:
Code: Date: July 1970

RECORD DESCRIPTION

FILE NAME: Station Data File RECORD NAME: Master Record

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
	1-2	Char	2	byte		char (2)	Originator's Nationality	NODC Country Code
	3-4	"	2	"		"	Ship Name	NODC Ship Code
	5-6	"	2	"		"	Degrees of Latitude	
	7-9	"	3	"		char (3)	Minutes of Latitude - 11 Over Punch in Position 8 for	
							South Latitude	
	10-12	"	3	"		"	Degrees of Longitude	
	13-15	"	3	"		"	Minutes of Longitude - 11 Over Punch in Position 14 for	
							East Longitude	
	16-18	"	3	"		"	Marsden Square	
	19-20	"	2	"		char (2)	Year (1900 to present)	
	21-22	"	2	"		"	Month of Year (01-12)	
	23-24	"	2	"		"	Day of Month	
	25-27	"	3	"		char (3)	Time (GMT to nearest 1/10 Hr.)	
	28-30	"	3	"		"	Originator's Cruise or Project Identification (Alphanumeric)	
	31-33	"	3	"		"	Originator's Station Identification (Alphanumeric)	
	34-37	"	4	"		char (4)	Depth to Bottom (Meters)	
							A in Position 34 for 10,000 Meter Prefix	
							B in Position 34 for 11,000 Meter Prefix	
	38	"	1	"		char (1)	Space Allocated for Data Users Code (Blank)	
	39-41						Blank	
	42-43	"	2	"		char (2)	Water Color (Forel-Ule Scale)	
	44-45	"	2	"		"	Water Transparency (Secchi Disc - Meters)	
	46-47	"	2	"		"	Wave Direction (WMO - Codes 0885 + 0887)	
	48	"	1	"		char (1)	Wave Height (WMO - Code 1555)	
							11 Over Punch in Position 48 Indicates Seastate WMO - Code	
							3700, Then Wave Period Must be Blank	
	49	"	1	"		char (1)	Wave Height - WMO - Code 3155	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Magnetic Tape Record Layout - Station Data for IBM 360/40

Page 2 of 4

Analyst:

Code: Date: July 1970

RECORD DESCRIPTION

FILE NAME: RECORD NAME: Master Record (continued)

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
	50-51	Char	2	byte		char (2)	Wind Direction - WMO Codes 0885 and 0887	
	52-53	"	2	"		"	Wind Speed (Knots), 11 Over Punch in Position 52	
							Indicates Wind Force (Beaufort Code)	
	54-56	"	3	"		char (3)	Barometric Pressure in Millibars - Tens, Units and 1/10s only	
	57-59	"	3	"		char (3)	Dry Bulb Temperature in Centigrade - 11 Over Punch in Position	
							59 Indicates Negative Temperature	
	60-62	"	3	"		"	Wet Bulb Temperature in Centigrade - 11 Over Punch in Position	
							62 Indicates Negative Temperature	
	63-64	"	2	"		"	Weather WMO Codes 4677 and 4501 - WMO Code 4501 is Used	
							When Position 63 Contains an X and a Digit Appears in Position	
							64	
	65	"	1	"		char (1)	Cloud Type - WMO Code 0500	
	66	"	1	"		"	Cloud Amount - WMO Code 2700	
	67		1				Blank	
	68-71	"	4			char (4)	Special Observations - Continuation of Originator's Station	
							Identification if Over Punch in Position 71	
	72-75	"	4			char (4)	NODC Reference Number - Assigned by NODC	
	76-79	"	4			char (4)	NODC Station Identification Number - Assigned by NODC	
	80	"	1			char (1)	Master Record Identified by a 1 (One)	
	80-83	"	3			Bit (24)	Various Master Record Flags	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Page 3 of 4 Magnetic Tape Record Layout - Station Data for IBM 360/40

Analyst:
Code: Date: July 1970

RECORD DESCRIPTION

FILE NAME: RECORD NAME: Detail Records (Observed #3 + Literature #4)

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
	1-24	Char	24	Byte			Repeat of First 24 Positions of Master Record	
	25-27	"	3	"		char (3)	Messenger Time in GMT to Nearest 1/10 Hr.	
	28-31	"	4	"		char (4)	Depth of Sample in Meters - 11 Over Punch in Position 31	
							for thermometric depth.	
	32	"	1	"		char (1)	Alphabetic code for precision indicator (NODC Codes)	
	33-37	"	5	"		char (5)	Temperature in centigrade - 11 overpunch in position 36 for	
							negative temperature - position 37 is alphabetic code for	
							precision indicator	
	38-42	"	5	"		char (5)	Salinity in parts/thousands - position 42 is alphabetic code	
							for precision indicator	
	43-46	"	4	"		char (4)	Sigma-T - 11 overpunch in position 46 for negative Sigma-T	
	47-50	"	4	"		char (4)	Sound velocity - meters/second by Wilson's formula	
	51-53	"	3	"		char (3)	Oxygen - milliliters/ liter - 11 overpunch in position 51	
							indicates oxygen greater than 9.99 add 10.00 to Oxygen value	
							11 overpunch in position 53 for doubtful oxygen.	
	54-56	"	3	"		char (3)	inorganic phosphate	
	57-59	"	3	"		char)3)	total phosphorus	
	60-62	"	3	"		char (3)	Nitrites	
	63-65	"	3	"		char (3)	Nitrates	
	66-68	"	3	"		char (3)	Silicates	
	69-71	"	3	"		char (3)	pH	
	72-79	"	8	"			repeat the values of positions 72-79 from Master Record	
	80	"	1	"		char (1)	Record Type 3 or 4	
	81-83	"	3	"		bit (24)	various detail record flags	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Magnetic Tape Record Layout - Station Data for IBM 360/40

Analyst:

Code: Date: July 1970

RECORD DESCRIPTION

FILE NAME: RECORD NAME: Detail Record (STANDARD code 6)

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
	1-24	Char	24	Byte			repeat of first 24 positions of Master Record	
	25-27	"	3	"		char (3)	Blank	
	28-32	"	5	"		char (5)	Depth - meters - position 32 blank	
	33-37	"	5	"		char (5)	Temperature - centigrade - 11 Overpunch in position 36 for negative temperature - Position 37 blank.	
	38-42	"	5	"		char (5)	Salinity in parts/thousand - position 42 always blank	
	43-46	"	4	"		char (4)	Sigma-T - 11 Overpunch in position 46 for negative Sigma-T	
	47-50	"	4	"		char (4)	Sound velocity - meters/second	
	51-53	"	3	"		char (3)	Oxygen in milliliters/liter - 11 Overpunch in position 51 indicates oxygen greater than 9.99 add 10.00 to oxygen value	
	54-59	"	6	"		char (6)	Blank	
	60-63	"	4	"		char (4)	Dynamic depth anomaly - 11 Overpunch in position 63 for negative value.	
	64-71	"	8	"		char (8)	Blank	
	72-79	"	8	"		char (8)	Repeat of the values from positions 72-79 from Master Record	
	80	"	1	"		char (1)	Record Type - Detail Record-STANDARD Code 6	
	81-83	"	3	"		bit (24)	Various Detail Record flags	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

APPENDIX V-2

NODC STATION DATA II FILE FORMAT

Analyst: Robert S. Van Wie
Code: ND41 Date: 2/2/71

RECORD DESCRIPTION

FILE NAME: STATION DATA II RECORD NAME: MASTER INFORMATION

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
CONTIN ≠	1	Byte				Char(1)	Non-zero ind. multi-rec.station	Continuation indicator
CNTRY ≠*	2	Byte				Char(3)	Alphanumeric bxx	Originator's nationality
CRUISE ≠*	5	Byte				Char(5)	Prefix '5'	NODC reference number
CONSEC ≠*	10	Byte				Char(4)	-	NODC consecutive number
RECID *	14	Byte				Char(2)	19 for NansenCast,62 for STD	Record Identification
AREACD ≠*	16	Byte				Char(2)	01-10	Ocean area
TENSQ ≠*	18	Byte				Char(4)	0-1735,starts at 20°E long.	Canadian ten degree square
ONESQ ≠*	22	Byte				Char(2)	00-99, Canadian system	One degree square
TWOSQ *	24	Byte				Char(2)	0-88 by 2's, Canadian	Two degree square
FIVESQ *	26	Byte				Char(1)	1-4, Canadian	Five degree square
LATHEM *	27	Byte				Char(1)	N or S	Hemisphere of latitude
LATDEG *	28	Byte				Char(2)	0-90	Degrees latitude
LATMIN *	30	Byte				Char(2)	0-60, blank	Minutes latitude
LTMNTN *	32	Byte				Char(1)	0-9, blank	Minutes latitude, tenths
LONHEM *	33	Byte				Char(1)	W or E	Hemisphere of longitude
LONDEG *	34	Byte				Char(3)	0-180 if 180 long.min=0,or blank	Degrees longitude
LONMIN *	37	Byte				Char(2)	0-60, blank	Minutes latitude
LNMNTH *	39	Byte				Char(1)	0-9, blank	Minutes latitude, tenths
QUARTR *	40	Byte				Char(1)	1, 2, 3, 4 or 9	Quarter degree square
YEAR ≠*	41	Byte				Char(2)	00-present, blank	Year
MONTH ≠*	43	Byte				Char(2)	1-12	Month of year
DAY *	45	Byte				Char(2)	1-31, blank	Day of month
STIME	47	Byte				Char(3)	blank 000-99.9, blank	Stationtime, GMT
SHIP *	50	Byte				Char(6)	alphanumeric, left justified	Ship,to be unique numeric code
DBOT *	56	Byte				Char(5)	0-11,999 or blank	Depth to bottom
DEPEFF *	61	Byte				Char(4)	Depth of deepest sound velocity	Effective depth
DURCST	65	Byte				Char(3)	From 3rd obs.record for STD data only	Cast duration

*Indicates field is in parameter inventory file
≠Sort Field

Form: 2430/2003-1063 - 3/10/70 - Rev. #4

Code: ND41 Date: 2/2/71

RECORD DESCRIPTION

E NAME: STATION DATA II RECORD NAME: MASTER INFORMATION (continued)

ATION OF RECORD TO THE FILE:

EMENT NAME / D LEVEL		LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
RACED		68	Byte				Char(1)	U, D, A or blank	Trace direction
IAL	*	69	Byte				Char(1)	0-9, blank at creation time	Quality indicator
IC	*	70	Byte				Char(1)	1-5, blank	Data use code
NDPTH	*	71	Byte				Char(4)	1st obs.depth w/validD,T & S	Minimum depth
XDPTH	*	75	Byte				Char(4)	Deepest valid observed param.	Maximum depth
XTRC1		79	Byte				Char(1)	Always 2	Next record indicator
EC1		80	Byte				Char(1)	Always 1	Record indicator
FDPTH	*	81	Byte				Char(4)	DBOT-DEPEFF,blank(can be minus)	Difference depth, meters
ERTSP	*	85	Byte				Char(2)	00-99, blank	Vertical sample spacing
ALPCT	*	87	Byte				Char(1)	0-9 or -	Percent salinity present
XPCT	*	88	Byte				Char(1)	0-9 or -	Percent oxygen present
O4PCT	*	89	Byte				Char(1)	0-9 or -	Percent inorganic P04 present
OTPCT	*	90	Byte				Char(1)	0-9 or -	Percent total phosphorous
IOPCT	*	91	Byte				Char(1)	0-9 or -	Percent silicates present
O2PCT	*	92	Byte				Char(1)	0-9 or -	Percent nitrites present
O3PCT	*	93	Byte				Char(1)	0-9 or -	Percent nitrates present
HPCT	*	94	Byte				Char(1)	0-9 or -	Percent PH present
RGCRS		95	Byte				Char(3)	Alphanumeric	Originator's cruise
RGSTA		98	Byte				Char(9)	Alphanumeric, left justified	Originator's station
OLOR	*	107	Byte				Char(2)	00-21, blank	Water color, Forel-ule code
RANS	*	109	Byte				Char(2)	00-99, blank, Secchi disk	Water transparency, meters
AVDIR		111	Byte				Char(2)	00-36, 49, 99, blank, 50-86	Wave direction, WMO Code 0885
EIGHT		113	Byte				Char(1)	0-9, X either height or blank	Wave height, WMO Code 1555
EASTA		114	Byte				Char(1)	Seastate always blank	Seastate, WMO Code 3700
ORCE		115	Byte				Char(2)	Blank if wind speed present	Wind force, Beaufort code
ILL2		117	Byte				Char(1)	U, D, O or 1.	Sorting control information

* Indicates field is in parameter inventory file

orm: 2430/2003-1063 - 3/10/70 - Rev. #4

3 of 6

Analyst: Robert S. Van Wie
Code: ND41 Date: 2/2/71

RECORD DESCRIPTION

E NAME: STATION DATA II RECORD NAME: MASTER INFORMATION (continued)

ATION OF RECORD TO THE FILE:

EMENT NAME D LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
RIOD	118	Byte				Char(1)	0-9,x,blank if seastate pre.	Wave period,WMO Code 3155
NDIR	119	Byte				Char(2)	Tens of degrees or blank	Wind direction,WMO Code 877
EED	121	Byte				Char(2)	Blank if wind force present	Wind speed, knots
ROM	123	Byte				Char(5)	09430-10449, blank	Barometric pressure,millibars
Y	128	Byte				Char(4)	bxx.x,bxx.b or blank	Dry bulb temperature,centigrade
YIN	132	Byte				Char(1)	0, 1, or 9	Wet bulb indicator ,precision
T	133	Byte				Char(4)	bxx.x, bxx.b or blank	Wet bulb temperature,centigrade
TIN	137	Byte				Char(1)	0, 1 or 9	Wet bulb indicator ,precision
EATHR	138	Byte				Char(2)	WMO Code 4501 is single digit	WMO Code 4501 or WMO Code 4677
PE	140	Byte				Char(1)	0-9, blank	Cloud type, WMO Code 0500
OUNT	141	Byte				Char(1)	0-9, blank	Cloud amount, WMO Code 2700
MOBS *	142	Byte				Char(3)	000-999	Number of observed depth
MSTN	145	Byte				Char(2)	00-34	Number of standard depths
MDET	147	Byte				Char(3)	000-999	Number of detail depths
LL9	150	Byte				Char(9)	Blank for word alignment	Not used
TRC2	159	Byte				Char(1)	3, 4, 6, or 7	Next record indicator
C2	160	Byte				Char(1)	Always 2	Record indicator

dicates field is in parameter inventory file

rm: 2430/2003-106B - 3/10/70 - Rev. #4

e 4 of 6

Code: ND41 Date: 2/2/71

RECORD DESCRIPTION

E NAME: STATION DATA II RECORD NAME: OBSERVED DEPTH INFORMATION

ATION OF RECORD TO THE FILE:

EMENT NAME / D LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
EPOBS	1	Byte				Char(5)	00000-12000	Depth, meters
EPIN	6	Byte				Char(1)	6,7,8,numeric cond.code or blank	Depth quality indicator
ERM	7	Byte				Char(1)	T for thermometric depth,blank	Thermometric depth
EPOBS	8	Byte				Char(5)	-4.0bb to 45.000	Temperature, centigrade
EMPRC	13	Byte				Char(1)	1,2, 3 or 9	Temperature, precision
EMPIN	14	Byte				Char(1)	7, 8 or condition,blank	Temperature quality indicator
ALOBS	15	Byte				Char(5)	0.0bb - 45.000	Salinity, parts/thousand
ALPR	20	Byte				Char(1)	1, 2, 3 or 9	Salinity precision
ALIN	21	Byte				Char(1)	7,8 or condition, blank	Salinity quality indicator
IGMAT	22	Byte				Char(4)	-4.00 to 45.00, blank	Sea water density, (G/L)
IGIND	26	Byte				Char(1)	8,9,numeric cond.code or blank	Sigma-t quality indicator
NDVEL	27	Byte				Char(5)	1300.0 -1600.0	Sound velocity, meters/sec.
NDPR	32	Byte				Char(1)	1 or 9	Sound velocity precision
XYOBS	33	Byte				Char(4)	00.0b-14.00, blank	Oxygen, milliliters/liter
XYPR	37	Byte				Char(1)	1, 2 or 9	Oxygen precision
XYIND	38	Byte				Char(1)	8 or blank	Oxygen quality indicator
TIME	45	Byte				Char(3)	00.b to 99.9, blank	Release time of messenger
ASTNO	48	Byte				Char(1)	0-9	Cast number
OSP	49	Byte				Char(4)	xx.xx, blank or bx.xx	Inorganic phosphate
IOSPR	53	Byte				Char(1)	1, 2, 4, 5, or 9.	Inorganic phosphate precision
OTPHP	54	Byte				Char(4)	blank or bx.xx	Total phosphorus
PHSIN	58	Byte				Char(1)	1, 2, 4, 5, or 9	Total phosphorus precision
IO3	59	Byte				Char(4)	blank or xxx.b	Silicates
IO3PR	63	Byte				Char(1)	0, 1, 4, 5, or 9	Silicates precision
O2	64	Byte				Char(3)	blank or x.xx	Nitrites
O2PR	67	Byte				Char(1)	0, 1, 4, 5, or 9	Nitrites precision

orm: 2430/2003-1063 - 3/10/70 - Rev. #4

Code: ND41 Date: 2/2/71

RECORD DESCRIPTION

E NAME: STATION DATA II RECORD NAME: OBSERVED DEPTH INFORMATION (continued)

ATION OF RECORD TO THE FILE:

EMENT NAME D LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
)3	68	Byte				Char(3)	blank or xx.x	Nitrates
)3PR	71	Byte				Char(1)	0, 1, 4, 5, or 9	Nitrate Precision
!	72	Byte				Char(3)	blank or x.xx	PH
HPR	75	Byte				Char(1)	1, 2, 4, 5, or 9	PH indicator
3SFLG	76	Byte				Char(3)	From EDIT Program	Status Report bits
	4	Bit					Phosphate GT 4.00	
	5	Bit					Total Phosphorus LT Phosphate	
	6	Bit					Silicate-Silicon GT 3.00	
	7	Bit					Nitrite-Nitrogen GT 4.00	
	8	Bit					Nitrate-Nitrogen GT 45.0	
	9	Bit					PH LT 7.40 or GT 8.50	
	19	Bit					SIGMA-t decreases by more than	0.02
XTOBS	79	Byte				Char(1)	1, 3, 4, 6 or 7	Next record type
3STYP	80	Byte				Char(1)	3 or 4	Record type

e 6 of 6   Code: ND41 Date: 2/2/71

RECORD DESCRIPTION

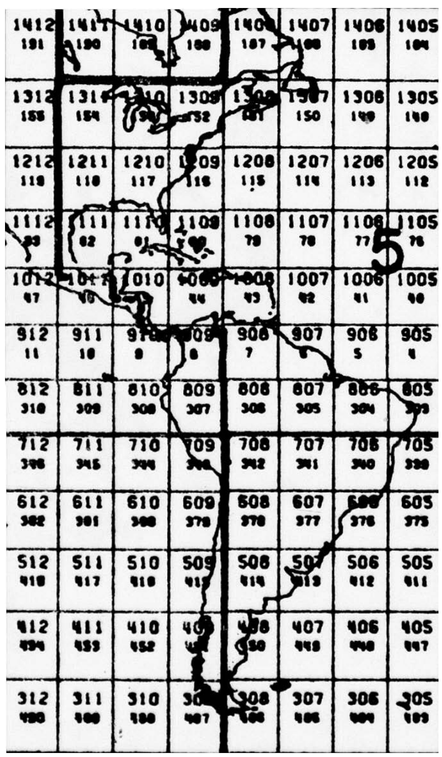
E NAME: STATION DATA II   RECORD NAME: STANDARD DEPTH INFORMATION

ATION OF RECORD TO THE FILE:

EMENT NAME D LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
DEPTH	1	Byte				Char(5)	00000-12000	Depth, meters
DEPIN	6	Byte				Char(1)	0-5	Depth quality
AD	7	Byte				Char(1)	blank for word alignment	Not used
TEMP	8	Byte				Char(4)	-4.00 to 44.00, blank	Temperature, centigrade
AD	12	Byte				Char(1)	Blank for word alignment	Not used
TEMPR	13	Byte				Char(1)	2 or 9	Temperature precision
AD	14	Byte				Char(1)	Blank for word alignment	Not used
SSALIN	15	Byte				Char(4)	00.00 to 45.00, blank	Salinity, parts/thousand
AD	19	Byte				Char(1)	Blank for word alignment	Not used
SSLPR	20	Byte				Char(1)	2 or 9	Salinity precision
AD	21	Byte				Char(1)	Blank for word alignment	Not used
SSIGT	22	Byte				Char(4)	-4.00-45.00, blank	Sea water density (G/L)
SSIGIN	26	Byte				Char(1)	9 or blank	Sigma-t quality indicator
SSVEL	27	Byte				Char(5)	1300.0-1600.0, blank	Sound velocity, meters/second
SNDPR	32	Byte				Char(1)	1 or 9	Sound velocity precision
SOXY	33	Byte				Char(4)	00.00-14.00, blank	Oxygen, milliliters/liter
SOXYPR	37	Byte				Char(1)	2 or 9	Oxygen precision
AD	38	Byte				Char(1)	Blank	Not used
SDYD	39	Byte				Char(5)	-2.000-4.000, blank	Dynamic depth anomaly
SDYDPR	44	Byte				Char(1)	3 or 9	Dynamic depth anomaly precis.
PADS	45	Byte				Char(31)	Blank for word alignment	Not used
STNFLG	76	Byte				Char(3)	From EDIT program	Status report bits
	19	Bit				Bit(1)	Sigmat decreases by more than 0.02	
NXTSTN	79	Byte				Char(1)	3, 4, 6 or 7	Next record indicator
STNTYP	80	Byte				Char(1)	6 or 7	Standard record type

APPENDIX V-3

CANADIAN/MARSDEN SQUARE CHART



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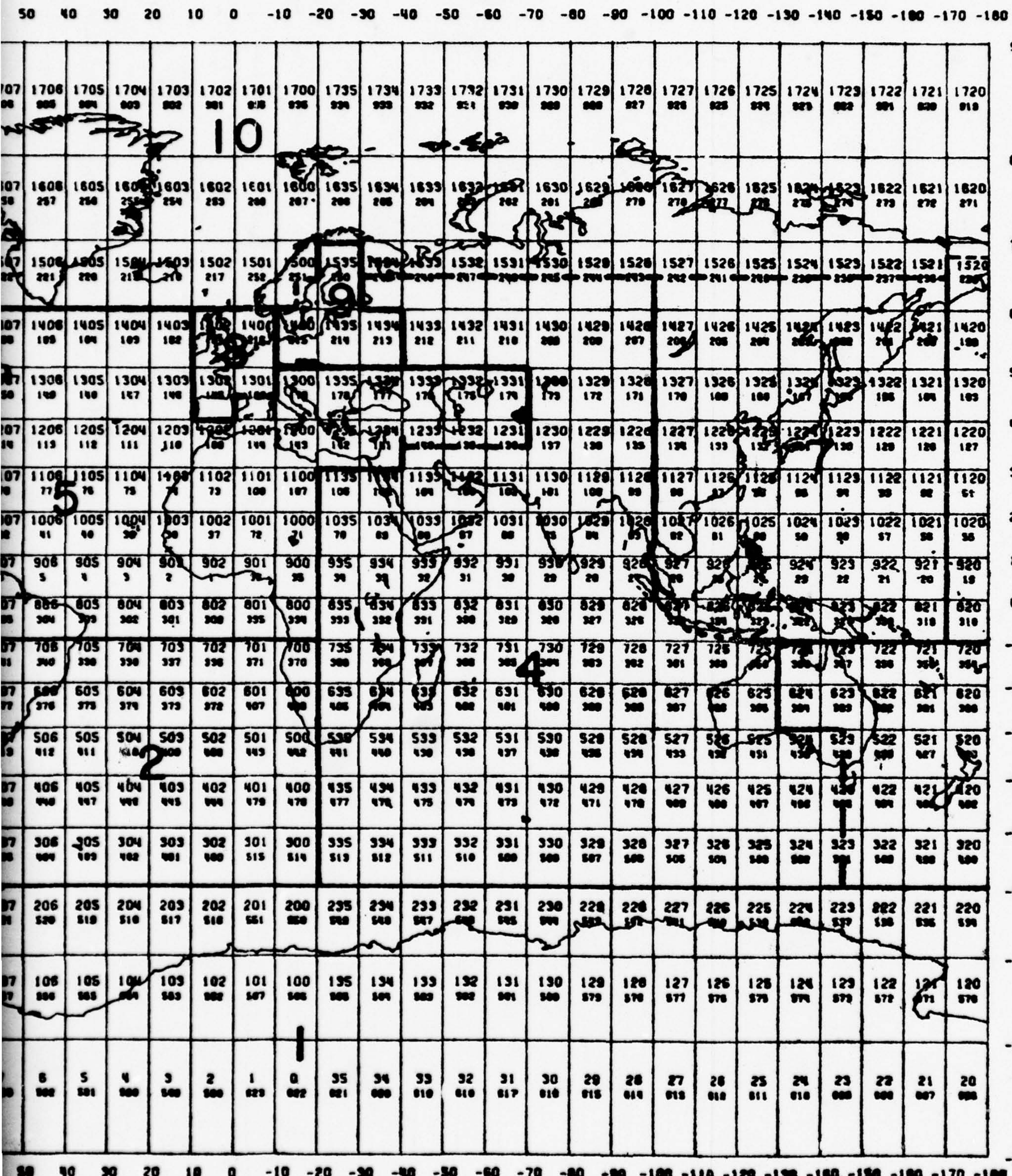
DIAN/MARSDEN SQUARE CHART

MAR 22 1972



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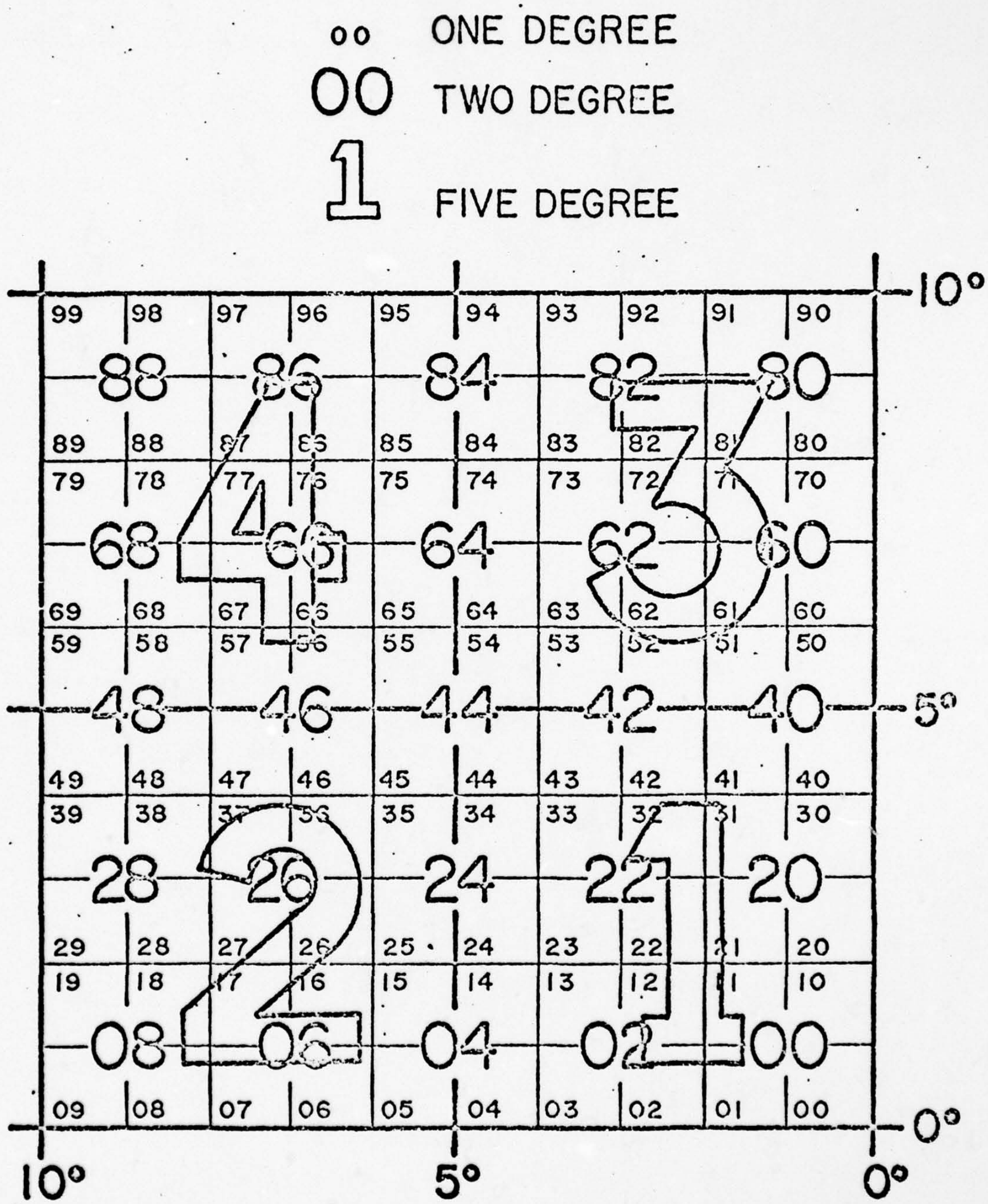
MODIFIED CANADIAN
TEN DEGREE SQUARE SHOWING SUBDIVISIONS



ALL SUBDIVISIONS OF 10° SQUARE ARE NUMBERED IDENTICALLY REGARDLESS OF QUADRANT OF THE GLOBE

ATTACHMENT 2

APPENDIX V-4

NODC BT FILE FORMAT

Magnetic Tape Record Layout - Bathythermograph Data for IBM 360/40 as of July 14, 1970

Page 1 of 2

Analyst:

Code: Date: 1/19/71

RECORD DESCRIPTION

FILE NAME: Packed Decimal BT File RECORD NAME:

RELATION OF RECORD TO THE FILE: File contains only one record type

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
	1-2	Byte	2	Byte		Fixed Dec. (3)	Always 106	
	3	"	1	"		Fixed Dec. (1)	Zero on All Records	
	4-5	"	2	"		Fixed Dec. (2)	99 = Blank on All Records	
	6-7	"	2	"		Fixed Dec. (3)	Marsden Square	
	8	"	1	"		Fixed Dec. (1)	Five Degree Square	
	9-10	"	2	"		Fixed Dec. (2)	One Degree Square	
	11-12	"	2	"		Fixed Dec. (2)	Month	
	13-15	"	3	"		Fixed Dec. (5)	NODC Reference Identity Number	
	16-18	"	3	"		Fixed Dec. (4)	NODC Consecutive Print Number	
	19	"	1	"		Fixed Dec. (1)	Zero on All Records	
	20-22	"	3	"		Char (3)	County Code - Left Adjusted	
	23-25	"	3	"		Char (3)	Institution Code - Left Adjusted	
	26-31	"	6	"		Char (6)	Ship Number - Left Adjusted	
	32-33	"	2	"		Char (2)	Ocean Weather Station (OWS) - Left Adjusted	
	34	"	1	"		Fixed Dec. (1)	NODC Quality Code	9 = Blank
	35-36	"	2	"		Fixed Dec. (3)	Precision Codes for Latitude, Longitude and Time	
	37-39	"	3	"		Fixed Dec. (4)	Latitude in Degrees and Minutes	
	40-42	"	3	"		Fixed Dec. (5)	Longitude in Degrees and Minutes	
	43-44	"	2	"		Fixed Dec. (3)	Year	
	45-46	"	2	"		Fixed Dec. (2)	Day of Month	99 = Blank
	47-49	"	3	"		Fixed Dec. (4)	Time in Hours and Minutes	9999 = Blank
	50-52	"	3	"		Fixed Dec. (5)	Depth of Trace	
	53	"	1	"		Fixed Dec. (1)	Depth Code	9 = Blank
	54	"	1	"		Char (1)	Control for Temperature Correction	
	55-56	"	2	"		Fixed Dec. (2)	Instrument Type	
	57-58	"	2	"		Fixed Dec. (2)	Input Units Code	
	59-60	"	2	"		Fixed Dec. (2,1)	Temperature Correction	9.9 = Blank

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Magnetic Tape Record Layout - Bathythermograph Data for IBM 360/40 as of July 14, 1970

Analyst:

Page 2 of 2

Code:

Date: 1/19/71

RECORD DESCRIPTION

FILE NAME: Packed Decimal BT File

RECORD NAME:

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
	61-62	Byte	2	Byte		Fixed Dec. (2)	Depth Correction	99 = Blank
	63	"	1	"		Fixed Dec. (1)	Reference Temperature Type	9 = Blank
	64-65	"	2	"		Fixed Dec. (3,1)	Reference Temperature	99.9 = Blank
	66-73	"	8	"		Char (8)	Originator's Cruise Number	
	74-77	"	4	"		Char (4)	Originator's Slide Number	
	78	"	1	"		Fixed Dec. (1)	Detail Data Type Code 0 = Normal; 1 = Card Type 50	
							Will Always Be Code 0	
	79-80	"	2	"		Fixed Dec. (2)	Length of Ship's Name - 26 on All Records	
	81-106	"	26	"		Char (26)	Ship Name	
	107-108	"	2	"		Fixed Dec. (3)	Depth of First Temperature	
	109-110	"	2	"		Fixed Dec. (3)	Interval Between Depths	
	111-112	"	2	"		Fixed Dec. (3)	Number of Depths	Max = 100
	113	"	2	"	*	Fixed Dec. (3,1)	Array of Temperatures	
					*	Repeat Factor	Indicated by Value in Position 111-112	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

January 25, 1971

NODC BT PROCESSING CODE
TABLE IV

BT GRID CODE	Maximum Depth of Grid		
	Feet	Meters	Fathoms
1	200	60	34
2	450	140	75
3	900	275	150
4	>1000	>300	>165
5	Rectilinear or Digital Output		

NODC BT PROCESSING CODE
TABLE VIII

BT Reference Temperature Code	Type of Device
1	Bucket Thermometer (variously indicated on BT prints as B, b, BKT, cl)
2	Injection Thermometer or, Unverified Bucket Notation (UB) or, Unknown (variously indicated on BT prints as K, UB, or no suffixed letter.)
3	Nansen Cast (reversing thermometer) (usually indicated on BT print as R)
4	Thermograph, etc. (indicated on BT print as TG)
5	Special calibration thermometer or equipment
6	BT surface (zero depth) temperature

NODC BT PROCESSING CODE
TABLE IX

BT Unit Code	Coding Interval & Grid Depth Unit	Grid Temperature Unit	TCS Unit	Reference Temperature Unit
01	10-feet	°F	°F	°F
02	5-meters	°C	°C	°C
03	10-feet	°F	°F	°F
04	5-meters	°C	°C	°C
05	5-meters	°C	°C	°F
06	10-feet	°C	°C	°C
07	5-meters	°C	°C	°F
08	10-feet	°C	°C	°C
09	2-fathoms	°F	°F	°F
10	5-meters	°C	°C	°C
11	5-meters	°C	°C	°C
12	6-meters	°C	°C	°C
13	6-meters	°C	°C	°C
14	5-meters	°C	°C	°C
15	10-feet	°F	°F	°C
16	10-feet	°F	°F	°C

PRECISION CODE
TABLE IX-A

CODE \ FIELD	TIME	LATITUDE	LONGITUDE
	Field was originally reported to the nearest...		
1	Minute	Minute	Minute
2	Tenth of Hour	Tenth of Degree	Tenth of Degree
3	Hour (or missing)	Degree	Degree

APPENDIX V-5

NODC XBT FILE FORMAT

Analyst: Pearl Johnson
Code: 2310 Date: 7 Aug 1970

RECORD DESCRIPTION

FILE NAME: XBT RECORD NAME: XBT - 9-Track Tape Format

RELATION OF RECORD TO THE FILE:

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
FILE ID 1	1	Byte	2	Byte		CHAR (2)	File I.D.	NODC Deck No.
QUADRT 2	3	"	1	"		CHAR (1)	WMO 3333	1-7
TEN SQ 3	4-6	"	3	"		CHAR (3)	Ten Degree Square (WMO)	000 - 918 Use with Qua
FIVE SQ. 4	7	"	1	"		CHAR (1)	Five Degree Square	1 - 4
TWO SQ 5	8-9	"	2	"		CHAR (2)	Two Degree Square	00 - 24
ONE SQ 6	10-11	"	2	"		CHAR (2)	One Degree Square	00 - 99
DATE								
YEAR 7	12-15	"	4	"		CHAR (4)	Prefix '19'	65 (GMT)
MONTH 8	16-17	"	2	"		CHAR(2)	01 - 12	
DAY	18-19	"	2	"		CHAR (2)	01 - 31	
TIME								
HOUR	20-21	"	2	"		CHAR (2)	00 - 23	
MIN	22-23	"	2	"		CHAR (2)	00 - 59	
REF ID								
CNTRY	24-26	"	3	"		CHAR (3)	NODC CODES	
REF NO	27-31	"	5	"		CHAR (5)		
CONSEC	32-34	"	3	"		CHAR (3)		
SHIP	35-40	"	6	"		CHAR (6)		
LATITUDE								
LAT DEG	41-42	"	2	"		CHAR (2)	00 - 90	
LAT MIN	43-44	"	2	"		CHAR (2)	00 - 59	
LAT HEM	45	"	1	"		CHAR (1)	N or S	
LONGITUDE								
LONG DEG	46-48	"	3	"		CHAR (3)	000 - 179	
LONG MIN	49-50	"	2	"		CHAR (2)	00 - 59	
LONG HEM	51	"	1	"		CHAR (1)	E or W	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Analyst: ____________
Code: ________ Date: ____________

RECORD DESCRIPTION

FILE NAME: ______________________ RECORD NAME: ______________________

RELATION OF RECORD TO THE FILE: ______________________

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
NODC CODES								
BOTTOM 22	52	Byte	1	Byte		CHAR (1)	B= Probe hit bottom, b = did not	B or blank
DIGMTH	53	"	2	"		CHAR (2)	Method of digitization	01 - 99 NODC Codes
INTER	55	"	2	"		CHAR (2)	Interval of digitization	01 - 99
TRESTO	57	"	2	"		CHAR (2)	Method of treatment + storage of initial points	01 - 99
OPERATOR								
INIT	59	"	3	"		CHAR (3)	Operator's Initials	
TRIAL	62	"	1	"		CHAR (1)	Number of attempts at digitizing trace	
CALDEP	63	"	3	"		CHAR (3)	Depth at Calibration Tick in Units of the analog grid	
CALTEM	66	"	3	"		CHAR (3)	Temperature at Calibration Tick in Units of the analog grid	
INSTRUMENT	69	"	1	"		CHAR (1)	1 = XBT, 2 = HXBT, 3 = SXBT, 4 = AXBT	
GRID 31	70	"	1	"		CHAR (1)	Grids Codes of the Instrument	1 - 9
Orig. Cr. No	71	"	8	"		CHAR (8)	Originators Cruise Number	Alpha-Numeric.
DNP	79	"	1	"		CHAR (1)	Declared National Program	1 - 4
SKIP	80	"	1	"		CHAR (1)	Blank For byte boundary alignment	
LENGTH	81	"	2	"		FIXED Binary (16)	Number of Temperature Values	

Page 3 of 3

Analyst: ______ Code: ______ Date: ______

RECORD DESCRIPTION

FILE NAME: ______ RECORD NAME: ______

RELATION OF RECORD TO THE FILE: ______

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
DEPTH & TEMP								
SURTEM	83	Byte	2	Byte		Integer	Temperature at zero depth to hundredths (1/100 insignificant)	
DEPTH	85	"	"	"		"	First Depth to whole meters	
TEMP (1)	87	"	"	"		"	Temperature at First Depth	
DEPTH (2)	89	"	"	"		"	2nd Depth	
TEMP (2)	91	"	"	"		"	2nd Temperature	
'								
'								
'								
'								
DEPTH (N)		"	"	"		"	Last Depth	Position = 4 * (N-1) + 83
TEMP (N)		"	"	"		"	Last Temperature	Position = 4 * (N-1) + 85
							Average Record Length	= 4 * (N-1) + 85. N= 40
								241 bytes

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Page 1 of 3

Analyst: Pearl Johnson
Code: D731 Date: 7 Aug 1970

RECORD DESCRIPTION

FILE NAME: XBT RECORD NAME: XBT 7-track Tape Output

RELATION OF RECORD TO THE FILE: Optional 7-track BCD Tape Format

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
FILE ID	1	Byte	2	Byte		CHAR (2)	File I.D.	NODC Deck No. 17
QUADRT	3	"	1	"		CHAR (1)	WMO 3333	1-7
TEN SQ	4-6	"	3	"		CHAR (3)	Ten Degree Square (WMO)	000-918 Use with Quad.
FIVE SQ	7	"	1	"		CHAR (1)	Five Degree Square	1-4
TWO SQ	8-9	"	2	"		CHAR (2)	Two Degree Square	00-88
ONE SQ	10-11	"	2	"		CHAR (2)	One Degree Square	00-99
DATE								
YEAR	12-15	"	4	"		CHAR (4)	Prefix '19'	65 (GMT)
MONTH	16-17	"	2	"		CHAR (2)	01-12	'
DAY	18-19	"	2	"		CHAR (2)	01-31	'
TIME								'
HOUR	20-21	"	2	"		CHAR (2)	00-23	'
MIN	22-23	"	2	"		CHAR (2)	00-59	'
REF ID								
CNTRY	24-26	"	3	"		CHAR (3)	NODC CODES	
REF NO	27-31	"	5	"		CHAR (5)	'	
CONSEC	32-34	"	3	"		CHAR (3)	'	
SHIP	35-40	"	6	"		CHAR (6)	'	
LATITUDE								
LAT DEG	41-42	"	2	"		CHAR (2)	00-90	
LAT MIN	43-44	"	2	"		CHAR (2)	00-59	
LAT HEM	45	"	1	"		CHAR (1)	N or S	
LONGITUDE								
LONG DEG	46-48	"	3	"		CHAR (3)	000-179	
LONG MIN	49-50	"	2	"		CHAR (2)	00-59	
LONG HEM	51	"	1	"		CHAR (1)	E or W	

Form: 2430/2003-106B - 3/10/70 - Rev. #4

Analyst: ____________
Code: ______ Date: ____________

RECORD DESCRIPTION

FILE NAME: ____________ RECORD NAME: ____________

RELATION OF RECORD TO THE FILE: ____________

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
NODC CODES								
BOTTOM	52	Byte	1	Byte		CHAR (1)	B = Probe hit bottom, b = did not	B or blank
DIGMTH	53	"	2	"		CHAR (2)	Method of digitization	01-99
INTER	55	"	2	"		CHAR (2)	Interval of digitization	01-99
TRESTO	57	"	2	"		CHAR (2)	Method of treatment + storage of initial points	01-99
OPERATOR								
INIT	59	"	3	"		CHAR (3)	Operator's initials	
TRIAL	62	"	1	"		CHAR (1)	Number of attempts at digitizing trace	
CALDEP	63	"	3	"		CHAR (3)	Depth at Calibration Tick in Units of the analog grid	
CALTEM	66	"	3	"		CHAR (3)	Temperature at Calibration Tick in Units of the analog grid	
INSTRUMENT	69	"	1	"		CHAR (1)	1 = XBT, 2 = HXBT, 3 = SXBT, 4 = AXBT	
GRID 3/	70	"	1	"		CHAR (1)	Grids Codes of the Instrument	1-9
ORIG CR NO	71	"	8	"		CHAR (8)	Originator's Cruise Number	Alpha-Numeric
DNP	79	"	1	"		CHAR (1)	Declared National Program	1-4
SKIP	80	"	1	"		CHAR (1)	Blank	
LENGTH	81	"	4	"		CHAR (4)	Number of Temperature Values	

Analyst: ____
Code: ____ Date: ____

RECORD DESCRIPTION

FILE NAME: ____ RECORD NAME: ____

RELATION OF RECORD TO THE FILE: ____

ELEMENT NAME AND LEVEL	LOCATION Position	LOCATION Units	LENGTH Number	LENGTH Units	REPEAT FACTOR	ATTRIBUTES: TYPE, BASE, MODE, LANGUAGE, PRECISION, ETC.	USAGE AND MEANING OF ELEMENT	CONDITIONS
DEPTH & TEMP								
SURTEM	85	Byte	4	Byte		CHAR (4)	Temperature at zero depth to hundredths (1/100 insignificant)	
DEPTH	89	"	4	"		CHAR (4)	First Depth to whole meters	
TEMP (1)	93	"	4	"		CHAR (4)	Temperature at First Depth	
DEPTH (2)	97	"	4	"		CHAR (4)	Second Depth	
TEMP (2)	101	"	4	"		CHAR (4)	Temperature at Second Depth	
'								
'								
'								
'								
DEPTH (N)		"	4	"		CHAR (4)	Last Depth	Position = 8 * (N-1) + 85
TEMP (N)		"	4	"		CHAR (4)	Last Temperature	Position = 8 * (N-1) + 89
							Average Record Length = 8 * (N-1) + 89	N = 40
								401 bytes

Form: 2430/2003-106B - 3/10/70 - Rev. #4

TABLE 1

Grid and Instrument Code

Instrument	Grid	Inst Code	Code
1 Shipboard XBT		1	
	2500 foot (Ft & F)		1
	750 meter (M & C)		2
	1500 foot (Ft & F)		3
	450 meter (M & C)		4
	1830 meter (M & C)		5
2 Helicopter XBT		2	
	Unknown		
3 Submarine XBT		3	
	Unknown		
4 Airborne		4	
	1000 (Ft & F)		1

TABLE 2

I.	**DIGITIZATION METHOD**	
a.	Manual	01
b.	A-D conversion from original	02
c.	A-D conversion from copies	03
d.	Optical scanning	04
e.	Direct digital output	05
II.	**INTERVAL CODE**	
A.	Fixed Interval	
a.	$\leq$1 m; and $\leq$0.1°C	01
b.	>1 m but $\leq$3 m; and $\leq$0.1°C	02
c.	>3 m but $\leq$6 m; and $\leq$0.1°C	03
d.	>6 m; and $\leq$0.1°C	04
e.	$\leq$1 m; and $\leq$0.2°C	11
f.	>1 m but $\leq$3 m; and $\leq$0.2°C	12
g.	>3 m but $\leq$6 m; and $\leq$0.2°C	13
B.	Variable (flexure points)	
a.	Manually determined	31
b.	Statistically determined	32
c.	Physically determined	33
C.	Combination of Fixed and Variable	
a.	Every 3 ft to 900 ft then flexure points below 900 ft	
III.	**DATA TREATMENT AND STORAGE CODE**	
A.	Single Digitization	
a.	No treatment, stored as digitized	01
	DATA COMPRESSION resulting in	
b.	Fit within 0.05°C	02
c.	Fit within 0.1°C	03
d.	Fit within 0.2°C	04
e.	Fit within 0.3°C	05
f.	Fit within 0.7°C	06
		07
B.	Dual Digitization and Averaging	
a.	No treatment, stored as digitized	21
	DATA COMPRESSION after averaging	
b.	Fit within 0.05°C	22
c.	Fit within 0.1°C	23
d.	Fit within 0.2°C	24
e.	Fit within 0.3°C	25
f.	Fit within 0.5°C	26
		27
C.	Data Points at Fixed Intervals or Selected Intervals Retained and Stored	

TABLE 3

National Oceanographic Data Center
August 27, 1970

The WMO Quadrant System for 10° Square Sort-Retrieval

In the WMO quadrant system, the identity of a 10° square can be directly established from the latitude and longitude of a data point and by the widely used WMO Code 3333 for quadrant of the globe. Except for the one-digit quadrant code, no key or chart or code table is needed for 10° square coding or identification.

The WMO quadrant code for 10° squares consists of 4 digits. The first digit denotes the quadrant of the globe according to WMO Code 3333 (Q_c) (WMO Pub No. 9 T.P. 4, Vol. B, amended 1968) NE = 1, SE = 3, SW = 5, NW = 7. The second digit is the tens digit of latitude. The third and fourth digit are the hundreds and tens digit of longitude. The digits depending on latitude and longitude can be derived directly from the coordinates of a data point. For example, position 75°N, 113°E would be located in the ten-degree square 1711. The ten degree square can also be defined as a bounded area, consisting of the WMO Code 3333 followed by the latitude (bounding the square) closest to the equator and by the longitude closest to the Greenwich meridian, both divided by 10. For example, the area bounded by 70°00'-80°00'N latitude and 100°00'-110°00'E longitude would be designated 10° square 1710.

Each ten-degree square is subdivided into 4 five-degree squares, 25 two-degree squares, and 100 one-degree squares. These are identical to the values previously used by NODC's Marsden Square System. Sub-squares are oriented so that the lowest number is located nearest the intersection of the equator and the Greenwich meridian.

The one-degree square consists of the units position of degrees of latitude in the first digit and the units position of degrees of longitude in the second digit.

The two-degree squares can be derived from the one-degree square: The two-degree square identifying number is always two even digits, from 00 to 88. Each square consists of the one-degree square corresponding to its identifier and the next higher one-degree square, plus the two squares 10 higher than the first two. For example, square 22 consists of one-degree squares 22, 23, 32, and 33 Therefore, position 61°N, 035°W would be in two-degree square 04.

The five-degree square in the NODC System is given by a single digit code, numbered 1, 2, 3, or 4. Square 1 is composed of the 25 one-degree squares whose first and second digits range from 0 through 4. Square 2 consists of the 25 one-degree squares whose first digit ranges from 0 through 4 and whose second digit goes from 5 through 9.

Square 3 has the one-degree squares which start with 5 through 9 and units digits of 0 through 4. Square 4 contains the remainder of one-degree squares.

Example, one-degree square 27 is in five-degree square 2, 44 is in 1, 60 is in 3, and 96 is in 4.

APPENDIX V-6

NAVOCEANO ACOUSTIC AND ACOUSTIC-RELATED DATA BANKS

NAVOCEANO DATA REPOSITORIES

Environmental data from NAVOCEANO's world-wide oceanographic, acoustic and geophysical surveys contribute information to working data files within the Office. NAVOCEANO retains the classified and specialized portions of those data having unique Navy concern, but transmits copies of the unclassified processed data to DOD data libraries and to the National Oceanographic Data Center (NODC).

The following list summarizes current NAVOCEANO data repositories:

1. Physical Properties of the Ocean

a. Ocean Station File: Depth, temperature, salinity, oxygen, chemistry and alkalinity data are contained in this file. These data were derived from Nansen and STD casts and are shown at standard oceanographic depths. Included also are computed parameters such as sigma-t and sound speed. Data are sorted by Marsden square, 1° square, and month. All data are stored on four 7-track magnetic tapes in Yergen "compressed" format packed at 556 BPI and include 420,000 stations as of January 1973. The file is fully automated with random access retrieval capability.

b. Bathythermograph (BT) Profiles: Approximately 700,000 BTs, sorted by Marsden square, 1° square, and month, exist on 25 tape reels in card image format. Work is in progress to compress file in Yergen format parallel to Ocean Station File. File is considered to be semi-automated.

c. Sea Surface Temperatures: A working file of about 34,000 SST values, on punch cards, exist for a special test area in the vicinity of the Gulf Stream (15°N - 55°N, 45°W - 90°W).

2. Ocean Currents

a. Surface Current File: A unique file of 4,000,000 surface drift observations updated as of December 1971. Two versions of this file are maintained: (1) a basic fully automated file stored on two reels of 7-track magnetic tape compacted in binary Yergen format at 556 BPI, and (2) a working version on one reel.

b. Subsurface Current File: Current meter data are on file on magnetic tape or on film. Graphic displays and digital print-outs are available. This working file contains 895 films of which 638 have been digitized and transferred to magnetic tape. Coverage is world-wide with many holiday areas. Additionally, a library file of 2,000 subsurface current profiles derived from literature and the above working file of current meter data is maintained.

Enclosure (1)

3. Sediment Properties

This fully automated file primarily contains sediment grain size distribution but also includes such data as: sound velocity structure, composition and texture, porosity and stress factors, for 75,000 samples. Data are on magnetic tape and can be retrieved either as a listing or CALCOMP plot.

4. Bathymetry

a. Digital Bathymetric Data Base: A Synthetic Bathymetric Profiling System (SYNBAPS) is under development which is designed to output digital profiles along great circle tracks up to 8000 miles in length. NAVOCEANO is preparing the bathymetric contour base charts which will be digitized by Calspan under ONR contract. A profiling capability for the Northern Hemisphere is planned by FY 75.

b. DOD Bathymetric Library: The Defense Mapping Agency maintains and directs the operation of this library which is physically located within NAVOCEANO. This Office has free access to these data and is a major contributor.

5. Magnetics

NAVOCEANO maintains the DOD Geomagnetic Data Library which contains both raw and processed data of the earth's magnetic field. The data contained are: Total Magnetic Intensity, Vertical and Horizontal Intensity, plus variation and dip.

6. Acoustic Data Files

a. Transmission Loss: Magnetic tape recordings of received pressure levels as a function of range are on file for 1500 stations taken in the Northern Hemisphere. Recordings are primarily of transmission loss for the bottom bounce path. This information has been digitized and is also tabulated in a library file.

b. Volume Reverberation: A library file of approximately 500 stations of volume reverberation data exist. Data has been processed as integrated scattering strength as a function of frequency and depth. Data exist in graphic and tabulated forms. Lesser amounts of bottom reverberation data are on file in a similar form.

c. Bottom Loss: Bottom loss as a function of grazing angle and frequency derived from the 1500 transmission loss stations are stored in digital form on magnetic tape as a library file.

d. Ambient Noise: A literature file on ambient noise, including biological noise, is maintained on microfiche and is in continuous update. Work is in progress to create a digital bank of ambient noise measurements from both Fleet and R&D sources. This is a

joint NAVOCEANO-AESD task and is scheduled for completion by April 1973. Associated software routines designed to permit rapid information retrieval and random access are in concurrent development.

e. False Target Data: File is used to complement data contained in ambient noise file. Information included in this file relate to distribution and density of whales and other potential false targets.

7. Bioacoustic File

A library file of information on the existence and occurrence of fouling organisms, plankton, deep scattering layer (DSL), mammals, sonic animals and bioluminescence is continued in microfiche copy form. File is indexed by author (Rolodex cards), subject, and either Marsden square or ocean basin (Keysort cards).

8. Climatology File

a. Summary Climatology File: This semi-automated file contains information on sea, swell, waves, air temperature, visibility, total clouds, and present weather by frequency distribution for 1° squares and by month. 15,000,000 observations derived from the Weather Bureau Surface Marine Deck are stored on six reels of 7-track magnetic tape and cover sources between 1850 and 1969. Data is compacted in Yergen binary format.

b. Basic Climatology File: File contains 25,000,000 individual observations of the same information listed above on 75 reels of 7-track magnetic tape in a similar compressed binary format.

9. Seismic Reflection Data

Data is recorded in analog form on dry paper seismic and fathometer records. In most cases, the analog records have been photographed and reduced to negatives which are kept on file.

10. Ice Data File

a. Top roughness: A working file of top-side ice roughness measurements taken with a laser profiler exist for 2,000 miles of great circle Arctic flights. Information is digitized on magnetic tape and available in tabulated form.

b. Bottom Ice Roughness: A library file of underside ice roughness measurements is maintained on magnetic tape.

c. Multiplatform Ice File: A semi-automated file of 47,000 ice concentration observations formatted in WMO code is contained in digital form on magnetic tape.

d. Local Ice File: A library file of ice conditions and concentration for Arctic ports and harbors.

APPENDIX V-7

NAVOCEANO INTERACTIVE GEOPHYSICAL DATA RETRIEVAL AND DISPLAY SYSTEM ATTRIBUTES

ATTRIBUTES OF INTERACTIVE GEOPHYSICAL DATA RETRIEVAL AND DISPLAY SYSTEM

1. Can generate over 20 distinct interaction displays including point plot annotation, scattergrams and contours of any parameter in a file.

2. Can execute several functions simultaneously such as retrieving one data set while displaying a second data set as well as interacting with a customer.

3. Can access Yergen's Compressed Ocean Station File.

4. Can access any card image file that contains one set of observations per card.

5. Can process random data via an objective analysis, generating a three dimensional grid from any set of X, Y, Z coordinates.

6. Can cut the three dimensional grids vertically or horizontally as requested interactively producing grid point annotation or a contour map of the plane cut specified.

7. A special option allows the specification of many horizontal cuts to be contoured and displayed in rapid succession generating a movie-like display which is helpful in analyzing large amounts of data.

8. System runs on the IBM-360-95 utilizing 1600 BPI tapes, 2315 disk units and an IBM 2250 250 MOD III vector generating scope with keyboard, function keys and light pen which are all used extensively for the interactive capability. (System was also run on 360-75 and 360-65.)

9. Programs are written in such a way as to allow easy conversion from computer to computer and from one display device to another.

10. The system is generalized so that the user can specify a new file and associated format from the 2250 console and start operating on that file immediately.

APPENDIX V-8

FNWC DISK FILE FORMATS

2.0 SCHEMATIC DIAGRAM OF THE STANDARD FNWC 6500 DATA FIELD IDENTIFICATION

Word	Bits	Contents
α	59–18	SYSTEM LABEL (EEEMMDH)$_{DSP}$
	17–0	No of 60 bit words in the field(L)
α+1	59–12	DATE-TIME GROUP (DTG) -- (YYMMDDHH)$_{XBCD}$
	11–2	TAU
	1–0	TU
α+2	59–45	Δ (i pole)
	44–30	Δ (j pole)
	29–21	M
	20–12	N
	11–6	Class
	5–0	TWP
α+3	59–48	LONG.X
	47–32	Re/d
	31–27	IND
	26–20	Scale Factor
	19–16	PR
	15	S_1
	14–10	Sect #
	9–6	Not Used
	5–0	Unit
α+4	59–36	HOUR OF THE CENTURY
	35–0	FILE NAME OF GENERATING PROGRAM
α+5	59–54	TWC
	53–0	PARAMETER NAME (PPPPPPPPP)$_{DSP}$
α+6	59–0	FIELD TITLE (DISPLAY CODE)
α+7	59–0	FIELD TITLE (DISPLAY CODE)
α+8	59–0	FIELD TITLE (DISPLAY CODE)
α+9	59–0	FIELD TITLE (DISPLAY CODE)
α+10	59–0	A -- CONTMAP SR CONSTANT (FLT PT)
α+11	59–0	B -- CONTMAP SR CONSTANT (FLT PT)
α+12	59–0	C(CI) -- CONTMAP (PLOT) SR CONSTANT (FLT PT)
α+13	59–0	D(CO) -- CONTMAP (PLOT) SR CONSTANT (FLT PT)
α+14	59–0	AD -- PLOT SR CONSTANT (FLT PT)
α+15	59–0	MP -- PLOT SR CONSTANT (FLT PT)
α+16	59–0	OPEN FOR FUTURE CONSTANT ADDITIONS
α+17	59–0	" " " " "
α+18	59–0	" " " " "
α+19	59–0	" " " " "
α+20	59–0	FIRST WORD OF DATA
	59–0	: : :
α+(L−1)	59–0	LAST WORD OF DATA

3.1.2 Definition of Terms

3.1.2.1 System Label - 42 bits

a. The System Label is used as the key for storing/retrieval of FNWC Data Fields by the ZRANDIO and MASTERF subroutines on the FNWC 6500 computers.

b. In order to avoid ambiguous system labels from one time period to another, each data field must have a unique system label relative to both the element name (parameter), e.g., pressure, temperature, omega, etc., and the observation time/forecast interval of the field.

c. The format of this system label is as follows:

$(EEEMMDH)_{DSP}$

where;

(1) EEE ≡ element name code. This code will be provided in the "FNWC Element Name Catalog."

(2) MM ≡ month/tau indicator. This indicator is computed as follows:

(MM) = month + 12* (tau)

where;

Month ≡ modified calendar month

(0,1,2,..11)

Tau ≡ forecast time

(3) H ≡ hour of the observation date

(0,1...23)

(4) D ≡ observation day (1,2,....31)

d. This system label may contain only alpha-numeric characters, i.e., no imbedded blank or special characters. Furthermore, the first character must be an alphabetic character in order to indicate to SCOPE that this is a 6500 central processor field.

e. The range of permitted alpha-numeric characters, in display code, are $(01)_8$ = A to $(44)_8$ = 9. Therefore, the number system that will be implemented to calculate MM, H and D is to the base (radix) 36 with the following order:

System Label No. System	Display Code	RADIX 36 Equivalent	No. System	Display Code	RADIX 36 Equivalent
A	01	00	S	23	18
B	02	01	T	24	19
C	03	02	U	25	20
D	04	03	V	26	21
E	05	04	W	27	22
F	06	05	X	30	23
G	07	06	Y	31	24
H	10	07	Z	32	25
I	11	08	Ø	33	26
J	12	09	1	34	27
K	13	10	2	35	28
L	14	11	3	36	29
M	15	12	4	37	30
N	16	13	5	40	31
O	17	14	6	41	32
P	20	15	7	42	33
Q	21	16	8	43	34
R	22	17	9	44	35

f. Example:

(1) The system label for the D500 field with an observation date of 06Z 15 March 1967 and a forecast time (tau) of + 24 hours is computed as follows:

(2) Element Name (EEE): $(FØØ)_{DSP}$

(3) Month/tau indicator

$$MM = \text{month} + 12 * \text{tau}$$

$$= 2 + 12 * 24 = 290$$

$$= 8 \cdot (36) + 2 \cdot (36)^0$$

$$= (IC)_{DSP}$$

(4) Hour (F) = 6 = $(G)_{DSP}$

(5) Day (D) = $(15)_{10} = (P)_{DSP}$

(6) Resultant System Label:

$(FØØICPG)_{DSP}$

3.1.2.2 Number of 60 Bit Words (L) - 18 bits

a. This count represents the total number of 60 bit words in the data field. The field is defined to include the complete data field, i.e., data and identification.

b. This value is scaled as a binary integer.

3.1.2.3 Date-Time Group (DTG) - 48 bits

a. This value represents the observation date of the field expressed in terms of external BCD characters.

b. The format is as follows:

$(YYMMDDHH)_{XBCD}$

where;

YY ≡ year $[(1201)_{XBCD}$ to $(1111)_{XBCD}]$

MM ≡ month $[(1201)_{XBCD}$ to $(0102)_{XBCD}]$

DD ≡ day $[(1201)_{XBCD}$ to $(0301)_{XBCD}]$

HH ≡ hour $[1212)_{XBCD}$ to $(0203)_{XBCD}]$

c. The sequence is reversed from previous FNWF DTG's. This new form is initiated in order to facilitate algebraic sorting of fields in future FNWC update programs.

3.1.2.4 Tau (forecast time) - 10 bits

This value represents the forecast time in binary. This value is scaled as a binary integer.

3.1.2.5 TU - 2 bits

a. This value represents the units of tau.

b. Format:

$(TU)_2$ = 00 - hours

= 01 - minutes

= 11 - seconds

3.1.2.6 Δ(i pole) - 15 bits

a. This value represents the number of grid intervals in the M (i row) direction to the pole, relative to the origin.

b. This value has an integer binary scale factor of S5.

3.1.2.7 Δ(j pole) - 15 bits

a. This value repreents the number of grid intervals in the N (j column) direction to the pole, relative to the origin.

b. This value has an integer binary scale factor of S5.

3.1.2.8 M - 9 bits

a. This value represents the number of grid columns in the data field.

b. This value is scaled as a binary integer, i.e., S0.

3.1.2.9 N - 9 bits

a. This value represents the number of grid rows in the data field.

b. This value is scaled as a binary integer, i.e., S0.

3.1.2.10 CLASS - 6 bits

This value represents the security classification of the data field. This classification is represented by a six bit display character. The following classification characters and their meanings are as follows:

CLASS = U - Unclassified
= C - Confidential
= S - Secret
= T - Top Secret

3.1.2.11 TWP - 6 bits

a. This value represents the number of 60 bit constant words contained in the identification area. The present identification configuratiion calls for 10 (60 bit) words.

b. This value is scaled as a binary integer, i.e., S0.

3.1.2.12 <u>LONG. X - 12 bits</u>

a. This value represents the longitude angle (meridian) that is parallel to the N (j, column) axis of the MxN grid, e.g., in the standard FNWC hemispheric 63 x 63 grid, this angle is 80° (relative to a 360° longitude compass; this system sweeps 0 to 360°, east to west). LONGX will be the western hemisphere meridian for hemispheric (north and south) grid fields. For zoom extracts, LONGX will be the meridian which is the most dominate in the field, e.g., an Indian Ocean zoom extract will have an eastern hemisphere meridian while a Carribean zoom extract will have a western hemisphere meridian.

b. This value has an integer binary scale factor of S3.

3.1.2.13 <u>Re/d - 16 bits</u>

a. This value represents the distance from the pole to the equator on the projection divided by the mean mesh distance (node to node) on the given grid field, e.g., on the standard FNWC hemispheric grid

this value is 31.205, i.e., (Re = 11,889.1 km)/(d = 381 km) = 31.205.

b. This value has an integer binary scale factor of S6.

c. This value is peculiar to polar stereographic projections. If another projection is used, a similar value would be substituted to give the scale of the earth's surface relative to the grid.

3.1.2.14 IND - 5 bits

a. This value indicates the nature of the data, i.e., floating point, unpacked fixed point or packed fixed point.

b. Options:

IND = 0 - Unpacked fixed point with the 47 most significant bits right justified (sign extended) in the 6500 60 bit word.

IND = 37 - Unpacked floating point.

IND = PP - Packed fixed point data. PP represents the number of bits of each packed datum, (range: 01 $\leq$ PP $\leq$ 36). It is recommended that one pack using an even integral of 60 in order

to keep the entire packed data type within a 60 bit word.

c. IND represents the packing nature of the field as it is last seen by the generating program. If the generating program writes it to a random common disk file, then IND = 0. IND will be modified by pack/unpack routines to reflect the fields packing status. Normally, the generating program will indicate an IND = 0 (unpacked-fixed point). An IND = 37 (unpacked-floating point) will only be used for local files or special common files. Do not write floating point fields to FNWC random common files or master tapes.

3.1.2.15 Scale Factor - 7 bits

a. This value represents the number of fractional bits (relative to the right side of a 48 bit word), i.e., integer binary scaling, for fixed point values contained in the field. In the case of packed data, this value applies to each datum within the packed word. This value has no meaning for floating point data fields.

b. This value is scaled as a binary integer, i.e., SØ.

3.1.2.16 PR - 4 bits

a. This value represents the hemisphere and type of projection the data field is constructed on.

b. The format of the PR field is $(HPPP)_2$. where;

H ≡ hemisphere of the projection

= 0 for Northern Hemisphere

= 1 for Southern Hemisphere

PPP ≡ projection.

Values, thus far, assigned are:

PPP = 000 - polar stereographic (true 60°)

= 001 - global band

= 010 - spherical

c. Example: Southern Hemispheric polar stereographic (true 60°S) - HPPP = 1000

3.1.2.17 S1 - 1 bit

a. This value indicates if this field is the first of a number of sections.

b. The values are:

S1 = 1 - first/only section

S1 = 0 - succeeding section

3.1.2.18 Section # - 5 bits

a. This value represents the section number

of the total data field. This number descends with succeeding sections, i.e., the first sections is the last section number as well as the count of the number of sections.

b. Example of a seven-sectioned field:

Sequence	S1	Section #
1	1	7
2	0	6
3	0	5
4	0	4
5	0	3
6	0	2
7	0	1

3.1.2.19 Units - 6 bits

This value is a six-bit binary code representing the units of the data contained in the field.

Units Code:

Code	Meaning
00	degrees Fahrenheit (°F)
01	degrees Absolute (°A)
02	degrees Centigrade (°C)
03	meters (m)
04	meters per second (m/s)

05	knots (kts)
06	miles per hour (m/h)
07	millibars (mb)
10	centimeters (cm)
11	$(\text{meter})^2/(\text{second})^2$
12	feet (ft)
13	degrees/1Ø (compass direction)
14	seconds (s)
15	gram-calories per cm^2 per day
16	nautical miles/day (nm/d)
17	centimeters per second (cm/s)
20	probability code
21	$°C/10^4\ (\text{kilometers})^2$
22	degrees (compass direction)
23	no dimension (ND)
24-77	no assignment

3.1.2.20 Hour of the Century - 24 bits

a. This value represents the hour of the observation date relative to the beginning of the century, i.e., 00Z 1 JAN 1900.

b. This value is scaled as a binary integer, i.e., S0.

3.1.2.21 File Name of Generating Program - 36 bits

This value represents either the program name of the generating program or the

associated operations job code (OP_ _).
This is to provide the program source identification for FNWC data fields, e.g., the D500 24 hour forecast can either be derived from the P.E model (OPB4) or the barotropic model (OP62).

3.1.2.22 TWC - 6 bits

This value represents the number of field title words contained within the identification area. The present configuration calls for 5 words. The first word contains nine display characters. The succeeding words contain 10 characters each.

3.1.2.23 Field Title

a. This display character string contains a verbal description of the data field.

b. The first nine characters contain the parameter name of the data, e.g., D_ _500, T_ _300, POTMLD, TS_500, etc. The succeeding characters provide further description if needed.

c. All unused portions of the field title must be filled out with blank, i.e., $(55)_8$, display code characters.

3.1.2.24 Field Constants

a. The present identification calls for six

constants to be provided to the contour-grid print (CONTMAP) and plot (PLOT) subroutines. The remaining four words are left open for future additions.

b. Constants A and B shall conform to the format specified in the CONTMAP subroutine writeup. Constants C, D, PD and MP shall conform to the format specified in the VARISET and PLOT65B subroutine write-ups.

c. All constants shall be expressed as unpacked, normalized floating point numbers.

d. Brief description of the constants:

(1) $P_{i,j} = B(A+Data_{i,j})$

where:

$Data_{ij} \equiv$ grid point data values contained within the field

$P_{ij} \equiv$ printed grid point values by CONTMAP subroutine

$A \equiv$ additive constant. Usually used to convert "D-value" to "Z-value" pressure height.

$B \equiv$ multiplicative constant. Used to move the decimal point for printout purposes. CONTMAP

prints the four digits immediately to the left of the decimal point of P_{ij}.

(2) $(\text{Band Index})_{i,j} = \frac{\text{DATA}_{i,j} - D}{C}$

where;

$(\text{Band Index})_{i,j}$ ≡ scaled values representing the data in terms of contour units.

C ≡ Contour interval. This value represents the desired spacing or interval of contours. It must be scaled and in the same units as $\text{Data}_{i,j}$.

D ≡ Contour origin. This value represents a base contour. The value is usually chosen midway in the spectrum of contours. In some cases, it may have a physical significance, e.g., the °0 line on a temperature chart. It must be scaled and in the same units as $\text{Data}_{i,j}$.

(3) Plot label constants AD and MP.

LABEL = AD + MP* $(\text{BAND INDEX})_{\text{CONTOUR}}$

where;

AD-A076 167 CALSPAN CORP BUFFALO N Y F/G 8/10
OCEANOGRAPHIC DATA BANK SURVEY.(U)
DEC 72 W E BLUM N00014-72-C-0466
UNCLASSIFIED CALSPAN-VH-5216-S-1 NL

2 OF 2
AD
A076167

END
DATE
FILMED
11 -79
DDC

LABEL ≡ values assigned and plotted with drawn contours. These values are derived from Band Index values not data values. Therefore, two orders of conversion are necessary to obtain the desired constant values. The plotted digits are the units and ten digits of LABEL.

AD ≡ plot additive constant. Analogous to A of CONTMAP.

MP ≡ plot multiplicative constant. Analogous to C of CONTMAP.

.1.3 Properties of this Field Format

3.1.3.1 The field identification is of fixed length, i.e., 20 (60 bit) words. However, within these 20 words the constant and title areas may vary.

3.1.3.2 The output subroutines CONTMAP (contour-grid print) and PLOT (plot program) will be designed to extract information in this format. This will enable processing of data fields without the need for lengthy tables of constants.

3.1.3.3 Unused portions within the identification area shall be filled in with binary zeros. The sole exception being the field title area where blank characters in display code are indicated.

APPENDIX V-9

FORMAT OF FNWC STATISTICAL CLIMATOLOGY FILE

	bits	1-15	16-21	22-36	37-42	43-56	57-60
Word 1		0 —— 0		Longitude		Latitude	Month

	bits	1-12	13 24	25-36	37-48	49-60
Word 2		Max Temp	Min Temp	Mean Temp	Standard Deviation	Total # of Observations

Word 20

word	2	represents	the	data	at	0 depth	19 standard FNWC depths.
"	3	"	"	"	"	100 feet	
"	4	"	"	"	"	200 feet	
"							
"							
"							
"							
"							
"							
"	20	"	"	"	"	5000 meters	

The temperatures are represented as binary numbers. 3° has been added to keep all values positive. The fields represent temperatures to 1/100 of a degree.

The tape is sorted by quadrants. The NE quadrant comes first, followed by NW, SE and SW.

APPENDIX V-10

PROJECT REPORT

FNWC OCEANOGRAPHIC CLIMATOLOGY PROJECT

HOWARD L. LEWIT, LCDR USN

FNWC OCEANOGRAPHIC CLIMATOLOGY PROJECT

1. Background
2. Available Data Sources And Processing Procedures
3, Data Preparation
4. Data Blending
5. Quality Control
6. Final Product
7. The Final Touches
8. Recommended Uses

Appendix A: Tape Families
Appendix B: Input Formats
Appendix C: Output Formats
Appendix D; Computer Programs

1. BACKGROUND

One of the primary missions of FNWC is to compute sound velocity in the ocean, as part of the ASW effort, and produce forecasts of sound velocity characteristics under varying oceanographic conditions and with varying ASW equipment.

In order to produce these forecasts it would be highly desireable to have a recent measurement of the medium's temperature and salinity or density. However, one of the scarcest parameters received by FNWC for analysis is bathythermal data, which average only several hundred reports per day for the Northern Hemisphere.

It is obvious, therefore, that in almost all sound velocity computations it is necessary to either revert directly back to climatological information or to blend near real-time soundings with climatology. The climatological fields of temperature and salinity have a long and rocky past but recently (spring 1971) were the subjects of an intensive task force improvement effort. This effort was documented by an extensive report by Mr. E. Hashimoto, which may be published some day.

The use of the climatological fields presents two problems.

a. Although the fields were greatly improved by the 1971 task force, some unreal profiles are known to remain. The further improvement of these fields is another "someday" project. (See comments section 8.)

b. Since the climatological fields represent an average of many reports or empirically derived numbers, it is not likely that an actual observation will smoothly blend with the climatological levels below it. This leads to sharp discontinuities in the profiles which in turn produce erroneous sound velocity computations.

On 7 October 1971 a meeting of representatives of the FNWC departments concerned with the problem was held with the intention of addressing the latter problem. At that time it was decided that in order to improve the blend of observations and climatology, it would be necessary to have fields of standard deviation of temperature.

In order to establish reliability, the number of reports used in the standard deviation computation would have to be known. The Climatology Department was tasked with combining all of the sub-surface temperature reports available to FNWC and producing a summary that would be:

a. by month

b. by two degree squares

c. by the 19 levels used by FNWC which are: 0, 100, 200, 300, 400, 600, 800, 1200 feet and 400, 500, 600, 800, 1000, 1500, 2000, 2500, 3000, 4000, and 5000 meters.

The parameters to be summarized were:

a. number of reports

b. mean value

c. standard deviation

Since the meeting I have added:

d. minimum temperature

e. maximum temperature

The Development Department was tasked with putting the data into FNWC 63x63 fields.

Shortly after the meeting I estimated the completion date of the Climatology Department effort to be 15 December 1971. The estimate turned out to be far too optimistic. There was so much programming and subjective checking involved that there was generally no time available to study data idiosyncrasies in depth or to backtrack to correct on occasional minor discrepancy or loss of data. I would estimate, however, that the final data is well over 99% clean and that significantly less than 1% of the available data was lost due to processing errors.

3. DATA PREPARATION

The first and most fundamental step was to read the data for processing. Several problems were encountered here.

a. The latest FOHIRS data was received at FNWC from NURDC, where the data was converted from BCD (more than 70 tapes) to binary (20 tapes). The conversion was designed to follow the format provided by FNWC (Technote #39, page 23) however there was some slight deviation from this without proper documentation. The NURDC programmers who provided the conversion are no longer available.

b. The XBT's received from NODC were in two different formats, neither one the same as FNWC's. The discription received from NODC for one of the formats was not correct, and some time was spent in modifying it.

Once the formats were deciphered, the NODC XBT's were combined with the FNWC XBT's and the SIO MBT's into one family. The data was checked for duplicates, sorted by month and by one degree squares by Mr. D. Dale.

The 4D reports were archived in BCD card images and filled nearly 50 magnetic tapes. I wrote a 1604 program to change the reports to binary and pack them in records of up to 1000 words. The data was reduced to less than 10 tapes, however the reports were separated by month and placed on 12 tapes. They were then checked for duplicates and geosorted by Mr. Dale.

The FOHIRS data was received in a Marsden square sort. In order to make it compatable with the other data however, it was geosorted and checked for duplicates by Mr. A. Church.

Each family of data was then run through program MON2 on the 6500. MON2 performed the following processing:

a. XBT and FOHIRS

Input:. several latitude bands within a global quadrant of reports of temperature for all months in increasing one degree squares.

2. AVAILABLE DATA SOURCES AND PROCESSING PROCEDURES

FNWC has a wealth of sub-surface data archived which were received from several sources. The sources and the approximate initial number of reports (October 1971) were:

a. XBT reports manually digitized at FNWC	60,000
b. XBT reports manually digitized at NODC	30,000
c. mechanical BT reports manually digitized at Scripps Institute of Oceanography by Mrs. M. Robinson under contract to FNWC (mostly Pacific)	105,000
d. Nansen casts from NODC	333,000
e. synoptic bathy reports received by FNWC and used in analyses (FNWC 4D Format):	500,000

In this report a, b and c will be referred to as XBT, d as FOHIRS and e as 4D. They are flagged on the project tapes and printouts as XB, FO and 4D respectively.

In general, the planned processing was:

a. sort each family of data by month and then geographically within the month.

b. remove intra-family exact duplicates.

c. convert each family into reports interpolated to the 19 standard levels and place all of the reports for a two degree square/month into one record.

d. combine the three families and remove inter-family duplicates.

e. perform objective quality control by flagging each report after:

(1) comparing each report with climatology

(2) comparing flagged reports with non-flagged reports in the same record.

f. subjectively designate reports to be removed from above flagged reports.

g. remove/correct erroneous reports.

h. perform final computations of required statistics.

Output: reports containing data interpolated into 19 standard levels separated into two degree squares per record, one entire month at a time but with all months for the given slice of geopraphy per tape.

b. 4D

Input: each tape includes all of one month's reports in increasing one degree squares.

Output: one month of interpolated reports separated into records of two degree squares.

The following were run through MON2 at least once: (See appendix A.)

XBT	13 tapes
FOHIRS	33 tapes
4D	12 tapes

The XBT and FOHIRS output were further processed on the 1604 to put all reports for each month together on a separate file of increasing two degree squares.

The final output of MON2 was:

Family	Reports
FOHIRS	186,117
4D	430,738
total	969,610

4. DATA BLENDING

Program MELD was written to combine the three families of data into monthly tapes. MELD sorted the reports into chronological order within the two degree square records and checked for duplicates both inter and intra family. In cases of duplication the order of elimination was 4D first and FOHIRS next, no XBT's were removed.

Cards were punched for each duplicate removed for use in removing the duplicates from the original masters. (See section 7 for recommended procedures.)

RESULTS OF MELD

	DUPLICATES		REPORTS REMAINING
	FO	4D	
JAN	131	3345	59,936
FEB	382	3445	67,061
MAR	470	3709	77,748
APR	299	3366	83,795
MAY	326	4198	95,798
JUN	605	4743	97,368
JUL	460	3605	95,793
AUG	768	3397	100,246
SEP	521	4759	75,670
OCT	443	2842	64,947
NOV	532	3054	60,314
DEC	280	1479	39,491

In order to reduce tape handling on the 6500, a monthly input tape was prepared on the 1604 consisting of each family as a separate file for use in MELD.

5. QUALITY CONTROL

The ideal method of quality control would have been to carefully investigate each report, consult atlases and expert authority and if necessary, go back to the original unimterpolated report to determine the causes or error.

Since I wanted to finish the job before the year 2000, I devised an objective method of identifying possible erroneous reports for further subjective decision.

The two programs I wrote for the purpose were COMPARE and QUALBT.

COMPARE in the Northern Hemishpere compares the interpolated profile with the FNWC climatology fields at the same location for the same month for a given tolerance range. The tolerance range was devised by Cdr. C. Barteau and Mr. W. Hubert by dividing the Northern Hemishpere into four zones (Figure 1) and providing a graph of ranges vs depth for each zone (Figure 2). The Southern Hemisphere does not yet have climatological fields for comparison, COMPARE uses extreme limits (Figure 3) prepared by Mr. E. Hashimoto, which are applied to the profile.

A Northern Hemisphere land/sea table is also used to find misplaced reports. It was found that this table was less than perfect along some coastlines and narrow channels and caused many reports to be flagged which were later found to be valid.

As a result of COMPARE the reports were flagged as follows:

a. Northern Hemisphere:

(1). not within .5 FNWC grid length of water - LAND (Figure 4)

(2). greater than one tolerance value but less than two - MIDR (Figure 5)

(3). greater than two tolerance values - OUTR (Figure 6)

b. Southern Hemisphere:

out of range SOUT (Figure 7)

c. All others:

remain flagged 11111

No reports were physically removed by COMPARE.

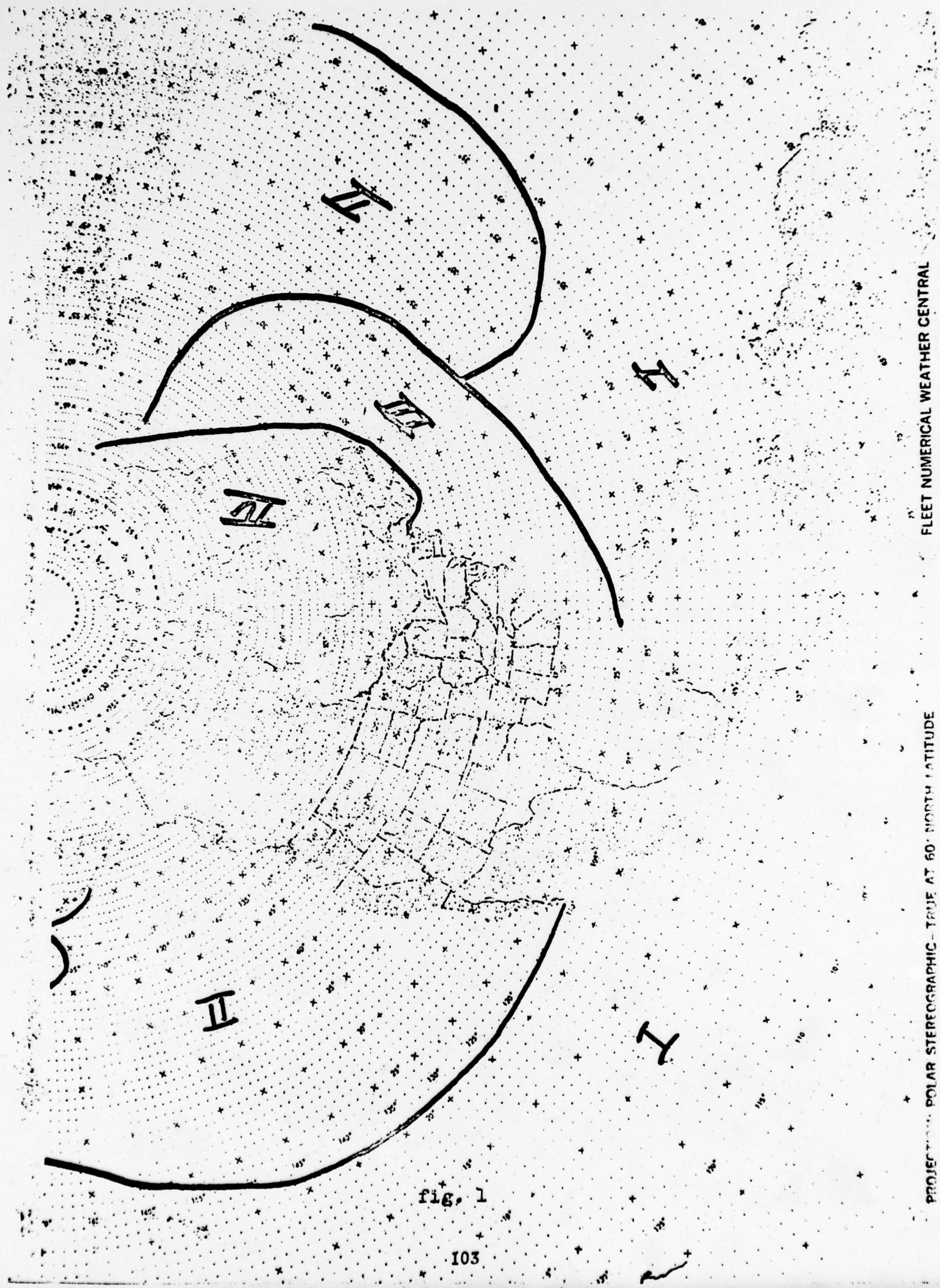
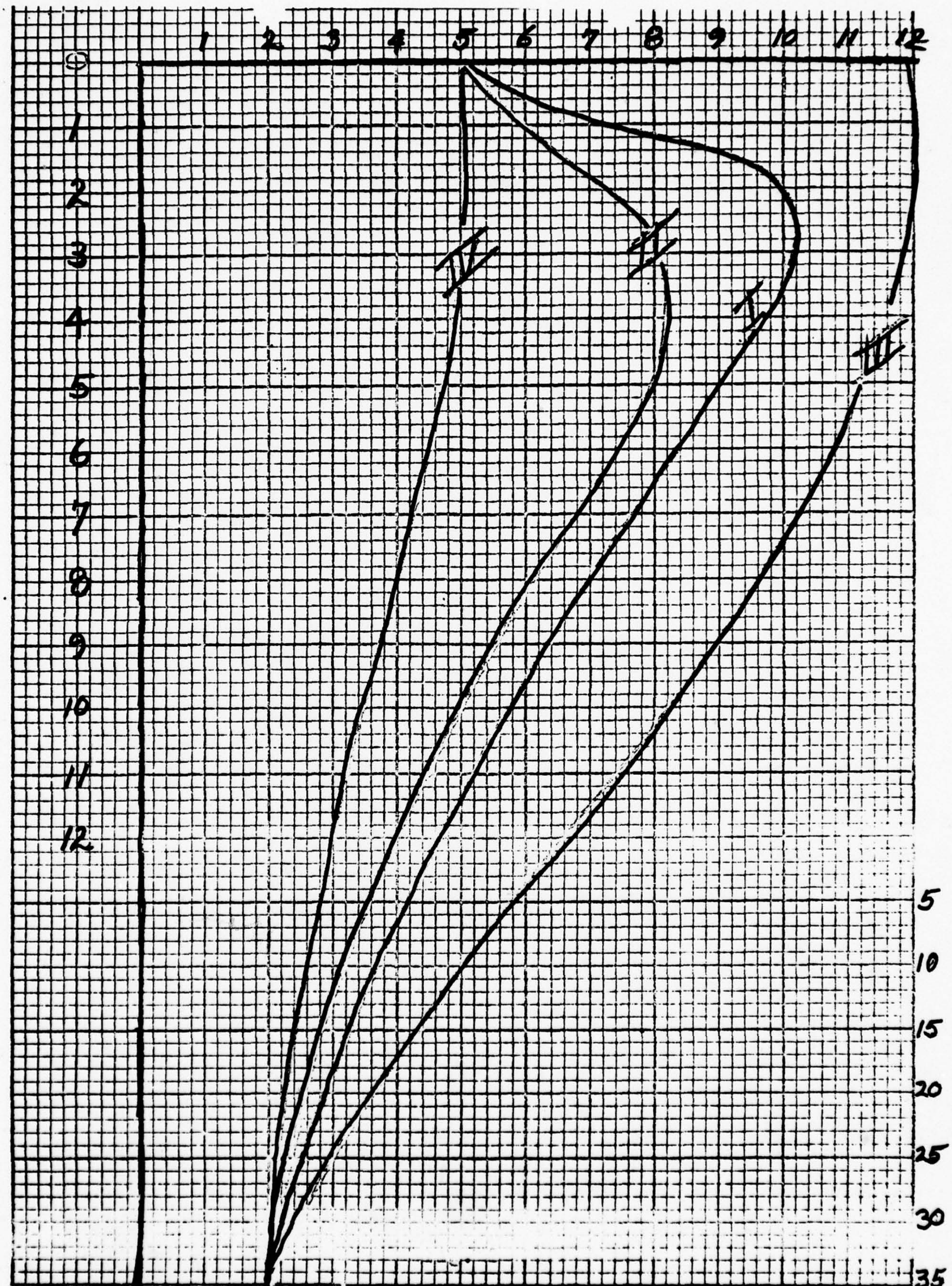

FLEET NUMERICAL WEATHER CENTRAL
PROJECTION: POLAR STEREOGRAPHIC - TRUE AT 60° NORTH LATITUDE
I
II
III
IV
V

fig. 1

fig.1(cont)



0
1
2
3
4
5
6
7
8
9
10
11
12
1
2
3
4
5
6
7
8
9
10
11
12
I
II
III
IV
5
10
15
20
25
30
35

Figure. 2

SOUTHERN HEMISPHERE LIMITS

DEPTH (METERS) \ LATITUDE	00 - 30	30 - 60	60 - 90
0	8/34	-2/29	-2/10
30	8/34	-2/29	-2/10
61	8/34	-2/23	-2/10
91	8/34	-2/23	-2/10
122	7/33	-2/23	-2/10
182	4/25	-2/20	-2/10
243	3/23	-2/17	-2/10
365	0/20	-2/17	-2/9
400	0/20	-2/15	-2/9
500	1/16	-2/15	-2/8
600	1/16	-2/10	-2/8
800	.7/11	-2/8	-2/7
1000	.4/8	-3/6	-2/6
1500	0/6	-3/6	-3/5
2000	-1/5.5	-3/6	-3/5
2500	-2/5	-3/6	-3/5
3000	-3/5	-3/6	-3/5
4000	-3/4	-3/6	-3/5
5000	-3/4	-3/6	-3/5

Figure 3

```
                        IJ     39.0     33.2
LAND POINT
SOURCE  FO  LAND    60 7N    2525E  5606010000
                        IJ     39.0     33.2
LAND POINT
SOURCE  FO  LAND    60 7N    2525E  5606100000
                        IJ     39.0     33.2
LAND POINT
SOURCE  FO  LAND    60 7N    2525E  5606210000
SECTOR  2 60N 27E
```

Figure 4

```
SECTOR  1   9N 53E
CLIMATOLOGY          RANGE   PROFILE
         24.2          5.0     29.3
         22.7          7.3     29.1
         23.0         10.0     24.9
         22.9         10.2     21.6
         22.0          9.7     17.9
         19.5          8.4     14.6
         15.8          7.0     13.3
         12.2          4.6     11.5
         11.6          4.5     11.5
SOURCE  XB  MIDR      920N    5313E   6706011130
FAILED COMPARISON
```

Figure 5

```
SECTOR  1   5N105E
CLIMATOLOGY          RANGE   PROFILE
         29.2          5.0     29.4
         28.6          7.3     28.6
         25.4         10.0     28.6
         21.3         10.2     28.5
         18.0          9.7     28.6
         15.1          8.4     28.5
         13.2          7.0     28.6
SOURCE  40  OUTR      525N   10536E   7006160830
FAILED COMPARISON
```

Figure 6

```
    MIN   MAX PROFILE
    8.0  34.0    28.4
    8.0  34.0    28.7
    8.0  34.0    28.7
    8.0  34.0    27.5
    7.0  33.0    27.3
    4.0  25.0    28.4
    3.0  23.0    28.9
    0.0  20.0    18.5
    0.0  20.0    14.8
    1.0  16.0    17.7
    1.0  16.0    12.3
     .7  11.0     9.9
     .4   8.0    12.6
    0.0   6.0    10.8
   -1.0   5.5     8.6
SOURCE  FO  SOUT      7 5S    9851E   6306201000
FAILED COMPARISON
```

Figure 7

```
4D MIDR      238N   8915E  7101040525
IDENT CHANGED TO
4D FEW       238N   8915E  7101040525
LEVEL  TEMP
   0.  30.6                 T
  30.  30.6                 T
  61.  30.6                 T
  91.  30.7                 T
 122.  29.3               T
 182.  15.3 T
 243.  14.4 T

4D 11111     336N   8806E  6601260200
LEVEL  TEMP
   0.  28.6             T
  30.  28.4             T
  61.  28.1             T
  91.  26.1           T
 122.  16.1 T

4D 11111     339N   8858E  7101280430
LEVEL  TEMP
   0.  28.7                T
  30.  28.2               T
  61.  27.9               T
  91.  27.1              T
 122.  24.0           T
 182.  14.1  T
 243.  12.3T
```

Figure 8

Results of COMPARE

	Total	MIDR	OUTR	LAND	SOUT
JAN	59,936	637	124	86	177
FEB	67,061	1191	170	46	81
MAR	77,748	1014	137	38	115
APR	83,795	964	207	40	86
MAY	95,795	1758	153	70	61
JUN	97,368	2197	249	102	82
JUL	95,793	2800	238	328	112
AUG	100,246	4248	324	664	111
SEP	75,670	2536	308	503	52
OCT	64,947	1109	147	183	73
NOV	60,314	788	147	75	41
DEC	39,491	362	125	55	53

QUALBT computes mean and standard deviation for those reports in each two degree square which were not flagged by COMPARE and compares the mean and standard deviation with the flagged reports (except LAND reports which were visually compared against geography). After the comparison the flags were revised as follows:

a. fewer than six unflagged reports available in the record, all reports in the record are printed and the flagged report is changed to FEW (Figure 8).

b. flagged report less than 2.5 standard deviation from mean at all levels, flag reverted to 11111 (Figure 9). In a few isolated instances it was seen that the reversion was not warrented and data car was manually punched.

c. flagged report between 2.5 and 5.0 standard deviations from the mean, flag changed to MED (Figure 10).

d. flagged report greater than 5.0 standard deviations from mean, flag changed to HIGH (Figure 11).

e. flagged report deeper than available mean for comparison, flag changed to DEEP (Figure 12).

Cards were punched for all reports flagged other than 11111 for further subjective selection.

```
FO MIDR      3948N   6355W  6701181400
 ACCEPTED AND IDENT CHANGED TO
FO 11111     3948N   6355W  6701181400
LEVEL   TEMP                       MEANS                      S.D.     AMOUNT
   0.   20.8               T       20.2                     M  2.0       11.
  30.   20.8               T       20.1                     M  2.0       11.
  61.   20.3               T       19.9                     M  2.0       11.
  91.   20.2               T       19.5                     M  1.9       11.
 122.   20.1              T        19.2                    M   1.8       11.
 182.   18.9              T        18.6                    M   2.4        9.
 243.   18.3              T        17.5                   M    3.3        7.
 365.   17.2             T         17.0                  M     1.2        6.
 400.   16.8             T         16.5                  M     1.4        6.
 500.   14.8           T           14.9                 M      1.0        4.
 600.   11.8         T             11.8               M        1.1        4.
 800.    7.0     T                  6.9           M             .9        4.
1000.    5.0 T                      5.3         M               .2        4.
1500.    4.1T                       4.1        M                .1        2.
```

Figure 9

```
XB MIDR      1910N  11627E  6901290600
IDENT CHANGED TO
XB MED       1910N  11627E  6901290600
POINT GREATER THAN 2.5 STANDARD DEVIATION
LEVEL   TEMP                      MEANS                         S.D.    AMOU
   0.   29.4                T     24.1                       M  1.2     80
  30.   27.9               T      23.8                       M  1.2     66
  61.   26.1             T        23.1                      M   1.6     62
  91.   22.8           T          21.3                    M     2.0     55
 122.   21.1         T            19.4                   M      2.3     44
 182.   17.8      T               16.4                M         2.3     35
 243.   16.2    T                 13.7              M           1.8     29
 365.   13.3 T                    10.0          M                .8     21
 400.   12.7T                      9.3         M                 .7     21
```

Figure 10

```
4D MIDR      1933N   11943E  7001100600
IDENT CHANGED TO
4D HIGH      1933N   11943E  7001100600
POINT GREATER THAN 5.0 STANDARD DEVIATION
LEVEL  TEMP                    MEANS                              S.D.       AMOUNT
   0.  25.0         T          24.8                            M  1.4           64.
  30.  25.5           T        23.5                           M.  1.6           51.
  61.  23.3        T           21.1                         M     2.0           50.
  91.  21.8      T             18.9                       M       2.0           47.
 122.  20.8    T               17.1                     M         2.1           43.
 182.  19.3   T                14.4                 M             1.7           38.
 243.  18.3 T                  12.5                M              1.3           35.
 365.  19.4  T                 10.3            M                  1.3           22.
 400.  19.0 T                   9.7            M                  1.1           20.
```

Figure 11

```
TEMPERATURE LENGTH GREATER THAN MEAN LENGTH
4D MIDR      1318N   10936E  6901241800
IDENT CHANGED TO
4D DEEP      1318N   10936E  6901241800
LEVEL  TEMP                    MEANS            S.D.       AMOUNT
   0.  27.8           T        24.7          M  1.4          174.
  30.  27.7           T        24.3          M  1.3          167.
  61.  27.6           T        24.0          M  1.3          137.
  91.  27.4           T        23.4        M    1.5          104.
 122.  27.3           T        22.1      M      2.2           48.
 182.  25.2       T            17.4   M         2.5           10.
 243.  21.2T                    0.0  M          0.0            0.
```

Figure 12

Results of QUALBT

	CARDS	LAND	MED	HIGH	FEW	DEEP	REVERTED TO 11111
JAN	724	86	173	344	77	54	300
FEB	1090	46	435	422	102	65	398
MAR	938	38	344	401	71	84	366
APR	1043	40	422	391	116	74	254
MAY	1367	70	693	418	88	107	666
JUN	1793	102	694	723	67	207	837
JUL	2347	328	829	617	377	196	1131
AUG	3828	664	1203	738	932	291	1519
SEP	2820	503	605	446	1095	171	579
OCT	1159	183	419	309	119	129	253
NOV	809	75	260	297	81	96	242
DEC	472	55	134	206	46	31	123

COMPARE and QUALBT provided flagged reports for subjective removal. While weeding through the reports to be removed, I took into consideration the fact that the climatology used in COMPARE was less than perfect. I also removed many reports that appeared to be valid but due to the density of reports would strongly bias the data to anomalous conditions during an isolated period. (Some observations were taken as frequently as every four minutes for several days.) In a few isolated instances, anomalous reports that appeared valid but were in sheltered positions and varied strongly from climatology and open ocean conditions were removed.

In order to remove unwanted reports, I wrote the program REJECT. While working with the individual reports I noticed situations that motivated me to modify REJECT. The situations and the modifications were as follows.

a. Some FO reports had no temperature data. These may have contained only salinity or some other parameter, however the only way to tell for sure will be to return to the original traces. These reports were removed by REJECT.

b. Some near duplicates were present and, in spite of all of the previous filters, some exact duplicates remained in the FO reports. REJECT was modified to recognize and print reports

with exactly the same heading. If the two reports were within $.5^{o}C$ of each other at all levels, one report was removed. If not, both reports were retained for subjective decision-this produced some surprises later on.

c. Some reports were good except for one or more levels which were incorrect. REJECT was modified to correct up to eight levels from tho data card input.

REJECT was run from two to five times for each month and should be used for any future removal or correction of invalid reports on the project tapes.

The first run of REJECT was made of the tapes without removal/correction data cards to remove duplicates, list near duplicates and remove reports with no temperature data.

REJECT RUN #1

	INITIAL REPORTS	DUPLICATES REMOVED FOH	XBT	4D	NO TEMPERATURE LEVELS
JAN	59,936	111	0	127	109
FEB	67,061	88	1	63	49
MAR	77,748	48	0	106	90
APR	83,795	254	9	157	45
MAY	95,504	236	3	196	139
JUN	97,370	151	2	179	249
JUL	95,793	311	2	169	89
AUG	100,246	80	2	61	306
SEP	75,670	111	0	103	130
OCT	64,947	58	0	54	117
NOV	60,314	40	1	102	58
DEC	39,491	20	4	14	71

Some of the near duplicates followed several patterns the causes of which could only be guessed at:

a. 4D same heading, and the data same only at several layers. 4D reports consist of several data cards which are read to tape as B C D card images. They were possibly read to

tape with one or more cards missing, then read in later with all cards, or received a second time and read in correctly.

b. 4D same heading, with one report having only surface temperature and another report the entire sounding, but a different surface temperature. The Sea surface temperatures reading and the bathy transmitted as two separate messages with same heading.

c. 4D exact duplicate but heading DTG defferent. Reports entered to ADP from two sources or twice from same source with different DTG. (This type of error was not identified by REJECT but incidentally encountered.)

e. FO up to 23 reports with same heading, but all different soundings. Major investigation with several ships involved but entered on tape as one collective and one heading.

f. FO same heading, slightly different sounding. Both original Nansen cast and corrected standard-level interpolation entered on same tape by NODC.

It can be seen that from both the first run of REJECT and the cards punched by QUALBT, that there were many subjective decisions to be made in a short period.

I estimate that about 1/3 of the reports under consideration were obviously bad, 1/3 were obviously good and about 1/3 required some judgement. I spent about one month on this problem and eventually removed less than 1% of the remaining reports. Several more (unavailable) months of careful investigation would be required to possibly salvage 10% of those removed.

REJECT RUN 1¼

	REPORTS		REMAIN			
	REMOVED	CORRECTED	XBT	FO	4D	TOTAL
JAN	548	50	11,677	16,474	30,890	59,041
FEB	419	90	12,866	23,801	29,774	66,441
MAR	452	48	14,664	25,821	36,568	77,053
APR	473	29	14,890	29,203	38,764	82,857
MAY	420	46	16,715	37,107	40,689	94,511
JUN	704	64	16,885	37,721	41,483	96,089
JUL	657	43	15,404	36,552	42,609	94,566
AUG	755	350	18,487	44,387	36,170	99,044
SEP	664	276	17,806	28,289	28,567	74,662
OCT	383	98	18,265	23,904	22,167	64,336
NOV	314	43	16,551	22,569	20,680	59,800
DEC	309	18	10,216	14,215	14,638	39,069

6. THE FINAL PRODUCT

The final effort was to compute the desired data, that is:

a. number of reports

b. mean

c. standard deviation

d. maximum value

e. minimum value

for 19 standard levels for every month and for each two degree square for which data exists.

Program FIN did the final computations and provided a quasi-geographic printout of the computed values. Due to the volume of the printout (about 160,000 lines) only one copy was made and is retained by Climatology.

Although every two degrees is on tape, including voids, the printout only contains latitude bands with non-zero data (Figure 13).

44N/126E 0 .0/0.0 0.0/ .0	44N/128E 0 .0/0.0 0.0/ .0	44N/130E 0 .0/0.0 0.0/ .0	44N/132E 0 .0/0.0 0.0/ .0	44N/134E 0 .0/0.0 0.0/ .0	44N/136E 3 1.1/ .3 1.5/ .3	44N/138E 33 2.8/ .9 5.3/ .8
40N/126E 0 .0/0.0 0.0/ .0	40N/128E 26 1.5/ .8 3.1/ .5	40N/130E 117 1.0/ .5 2.6/ .0	40N/132E 36 1.3/1.5 9.9/ .3	40N/134E 45 2.4/1.6 8.8/ .4	40N/136E 53 1.4/ .5 2.6/ .5	40N/138E 168 4.5/3.0 12.5/ .6
38N/126E 0 .0/0.0 0.0/ .0	38N/128E 113 2.0/1.3 6.1/ .3	38N/130E 27 4.3/3.2 11.4/ .8	38N/132E 109 4.0/1.9 11.1/ .3	38N/134E 113 5.4/2.6 11.4/ 1.0	38N/136E 82 8.0/3.1 16.2/ 2.0	38N/138E 98 8.7/2.3 12.7/ 2.4
36N/126E 0 .0/0.0 0.0/ .0	36N/128E 108 3.7/2.8 11.8/ .9	36N/130E 181 7.9/2.9 12.8/ 1.6	36N/132E 129 8.0/3.2 15.5/-1.3	36N/134E 255 10.5/3.5 16.2/ 2.1	36N/136E 23 11.2/2.1 14.4/ 5.0	36N/138E 20 9.8/1.1 12.6/ 8.6
34N/126E 0 .0/0.0 0.0/ .0	34N/128E 64 12.3/3.2 15.5/ 2.6	34N/130E 111 11.7/4.4 16.9/ 1.7	34N/132E 7 11.2/3.0 15.5/ 6.6	34N/134E 52 12.8/1.7 15.5/ 8.3	34N/136E 27 16.2/2.1 20.6/12.3	34N/138E 237 14.2/2.1 20.5/ 7.3
32N/126E 10 15.0/1.3 16.5/13.0	32N/128E 141 16.3/ .8 19.7/14.2	32N/130E 8 16.0/1.9 20.6/13.8	32N/132E 226 18.1/2.0 23.9/13.2	32N/134E 146 17.9/2.2 21.7/10.6	32N/136E 236 17.0/2.5 22.1/10.5	32N/138E 158 17.1/2.8 23.0/10.3
30N/126E 8 15.8/2.2 19.8/12.6	30N/128E 94 17.7/1.7 22.4/12.2	30N/130E 95 18.9/2.4 25.4/ 8.9	30N/132E 274 19.4/1.6 24.3/14.9	30N/134E 104 19.5/1.5 24.0/ 9.1	30N/136E 77 18.4/2.3 22.6/11.3	30N/138E 60 18.6/1.9 22.7/12.9
28N/126E 38 20.2/2.4 24.6/14.8	28N/128E 80 22.1/1.0 25.0/19.5	28N/130E 153 21.3/1.5 24.9/16.6	28N/132E 58 19.7/1.2 21.8/15.3	28N/134E 125 19.8/1.0 21.9/16.7	28N/136E 13 19.5/1.7 22.4/15.3	28N/138E 23 19.3/1.0 21.4/17.6

122 (Depth)

(Number of Repor

(mean)

(maximum)

(minimum)

(Standard Deviation)

(Latitude)

(Longtitude)

Figure 13

1.3 THE FINAL TOUCHES

The basic task is completed, and the final product is ready to be analyzed into fields, however some highly desireable work related to the project remains to be done.

One of the reasons for the large number of cards being punched for duplicate reports and erroneous data was to have these reports removed from the original masters. However I cannot emphasize too strongly that this should be done with great care. To blindly remove a report for each card punched would be a grave mistake. The only duplicates that should be removed from the masters are those that occur within the family.

As was previously mentioned, some reports were removed from the final product to reduce bias, however these were good reports and should not be removed from the masters.

Once the above reports are carefully removed, the job remains of devising a method of quality control for new reports and incorporating them onto the masters as a periodic update. The original master should be continually guarded against the indiscriminant addition or removal of reports.

8. RECOMMENDED USES

The final data and derived fields will represent a valuable and unique data base with uses only limited by imagination. Some recommended uses are:

a. the original motivation of the project which is the operational blending of real time reports with climatolgical fields,

b. improvement of the climatological fields, (The results of the project have shown some areas where the mean data would be superior to climatology-particularly in the northern latitudes and some deep layers.)

c. creation of an atlas showing mean profiles and standard deviation envelopes for selected two degree squares by month,

d. as a basis for Southern Hemisphere climatology, (The surface layer has been combined with the Marine Deck (TDF-11) data to provide a fairly complete Southern Hemisphere sea surface temperature by two degree squares/month. The remainder of the layers, although rather light on data, can form the basis for a Southern Hemisphere subsurface climatology.)

e. (Various agencies have already shown an interest in the project.) as a source of observation frequency at specified locations/depths,

f. as a quality control tool in bathy processing.

APPENDIX A: Tape Families

It is recommended that tape families marked * be retained. Those marked $ have been erased.

*1. Original sorted raw data(input master to MON2)

XB (input:()RAWXBT,(A-M)) 13 tapes

A	00-20	NE
B	20-36	NE
C	36-90	NE
D	00-12	NW
E	12-26	NW
F	26-32	NW
G	32-36	NW
H	36-40	NW
I	40-48	NW
J	48-58	NW
K	58-90	NW
L	00-90	SE
M	00-90	SW

FO (input: ()RAWFOH,(A-Q for NE,A-P for remainder)) 33 tapes

A	00-20	NE	A	00-22	NW
B	20-30	NE	B	22-30	NW
C	30-32	NE	C	30-40	NW
D	32-34	NE	D	40-44	NW
E	34-36	NE	E	44-46	NW
F	36-38	NE	F	46-48	NW
G	38-40	NE	G	48-50	NW
H	40-44	NE	H	50-56	NW
I	44-50	NE	I	56-58	NW
J	50-54	NE	J	58-60	NW
K	54-56	NE	K	60-64	NW
L	56-58	NE	L	64-70	NW
M	58-60	NE	M	70-90	NW
N	60-68	NE	N	00-30	SE
O	68-70	NE	O	30-90	SE
P	70-80	NE	P	00-80	SW
Q	80-90	NE			

4D (input: one tape for each month) 12 tapes

$2. Output of MON2

XB	()XBTCK,(A-M)	13 tapes
FO	()FOHCK,(A-Q andA-P)	33 tapes
4D	()4DOUT, (JAN-DEC)	12 tapes

$3. Stack of 2.(geographical)

XB

a.	00-90 NE,00-32 NW	1 tape
b.	32-90 NW,SE,SW	1 tape

FO

I	00-50 NE	1 tape
II	50-90 NE,00-40 NW	1 tape
III	40-90 NW,SE	1 tape
IV	SW	1 tape

*4. Stack of 3.(monthly)

XB

a.	January- June	1 tape
b.	July-December	1 tape

FO

a.	January-April	1 tape
b.	May-July	1 tape
c.	August-October	1 tape
d.	November & December	1 tape

$5. Input to MELD

-Monthly tapes with one file each of XB,FO,4D on each tape. 12 tapes

$6. Output of MELD

Combined families, most duplicates removed

4()HL,(A-L) 12 tapes

$7. Working duplicates of 6.

7()HL,(A-L) 12 tapes

$8. Output of COMPARE

10()HL,(A-L) 12 tapes

$9. Output of QUALBT

15()HL,(A-L) 12 tapes

$10. Output of REJECT(first run)

18()HL,(A-L) 12 tapes

*11. Output of REJECT(additional runs) 25 tapes

$20AHL	$20FHL
*21AHL	*21FHL
$20BHL	$20GHL
$21BHL	*21GHL
*22BHL	$20HHL
$20CHL	$21HHL
*21CHL	$22HHL
$20DHL	*23HHL
*21DHL	$20IHL
$20EHL	*21IHL
$21EHL	*20JHL
*22EHL	*20KHL
	*20LHL

*12. Output of FIN

25()HL,(A-L) 12 tapes

*13. Output of STACKOC

All of 12. on one tape 1 tape

APPENDIX B: Input Formats

1. Revised 4D packed

48-bit word

Word	48	42	36	30	24	12	6	1
I	SHIP CODE							
II	SUP		YYMMDDHHHH					
III	LAT		LATM	N/S	LONG	LONGM	E/W	
IV	NSST		IREF		SFCT			
V	48-BIT WORDS IN REPORT				REPORT #			
N	DEPTH(1)		TEMP(1)		DEPTH(2)	TEMP(2)		

60-bit word

Word	60	48	42	36	24	12	6	1
I	SHIP CODE					SUP		
II	YYMMDDHHHH				LAT	LATM	N/S	
III	LONG	LONGM	E/W	NSST	IREF	SFCT		
IV		48-bit WORDS IN RPT			REPORT #			
N	DEPTH(1)	TEMP(1)		DEPTH(2)	TEMP(2)	DEPTH(3)		

SHIP CODE	48-bit external BCD
SUP	supplementary information flag: (6-bit ext. BCD)
	D BT $\geq$ 1000 ft.
	C surface temp only
	B BT< 1000 ft.
	A ARTST
	S salinity values
	V sound velocity values
	H hydro cast(STD)
YYMMDDHHHH	36-bit DTG I10
LAT	whole degrees 12-bit I2
LATM	whole minutes 6-bit I2
N/S	6-bit ext.BCD
LONG	whole degress 12-bit I3
LONGM	minutes 6-bit I2
E/W	6-bit ext.BCD
NSST	SST from FNWC analysis 12-bit I4
IREF	reference temp from aboard ship 12-bit I4
SFCT	SST taken from aboard ship 12-bit I4

temperatures in °Fx10 12-bit

depths in feet*10 12-bit

48 bit words in report required for SORT program.

REPORT # up to 32 reports in one record, maximum of 1000 48-bit words in each record.

final DEPTH/TEMP pair for each report in the record=000/999

```
      PROGRAM ID4D72
C     THIS IS AN INTERIM PROGRAM TO PRINT REPORTS IN THE PACKED 4D FORMAT
C     INPUT LOGICAL 7   1604
C     PAUSE 555-PARITY ON INPUT-START TO READ NEXT RECORD
C     STOP 10-DEPTH-TEMPERATURE PAIRS EXCEEDED 75.
      DIMENSION MASS(1010)
      DIMENSION IDEPTH(75),ITEMP(75)
      K=0
      KP=0
      ID=ILN=0
610   DO 615 IG=1,1010
      MASS(IG)=0
615   CONTINUE
      PRINT 100
100   FORMAT(1H0)
      ID=ID-1
      IF(ID.NE.ILN)GO TO 999
      K=0
620   BUFFER IN(7,1)(MASS(1),MASS(1010))
 630  IF(UNIT,7)630,650,635,640
 635  PRINT 636
 636  FORMAT(2X,7HEOF TU7)
      REWIND 7
      GO TO 700
 640  PRINT 641
 641  FORMAT(2X,10HPARITY TU7)
      PAUSE555
      GO TO 620
 650  CONTINUE
      KP=KP+1
      ILN=LENGTHF(7)
      ID=1
 652  CONTINUE
```

```
      IF(MASS(ID).EQ.0.AND.MASS(ID+1).EQ.0) GO TO 610
      ISHIP=MASS(ID)
      ITIME=LBITS(1,36,MASS(ID+1))
      LAT=LBITS(37,12,MASS(ID+2))
      LATM=LBITS(31,6,MASS(ID+2))
      LATS=LBITS(25,6,MASS(ID+2))
      LONG=LBITS(13,12,MASS(ID+2))
      LONGM=LBITS(7,6,MASS(ID+2))
      LONGS=LBITS(1,6,MASS (ID+2))
      KT=LBITS(1,24, MASS(ID+4))
      IWD=LBITS(25,24,MASS(ID+4))
      ISST=LBITS(13,12,MASS(ID+3))
      PRINT 655,ISHIP,LAT,LATM,LATS,LONG,LONGM,LONGS,ITIME,ISST,IWD
655   FORMAT(X,A8,2X,2I2,R1,2X,I3,I2,R1,2X,I10,2X,I5,2X,I10)
      IC=ID
      DO 25 JP=1,75,2
      IDEPTH(JP)=LBITS(37,12,MASS(IC+5))
      ITEMP(JP)=LBITS(25,12,MASS(IC+5))
      IF(IDEPTH(JP).EQ.0.AND.ITEMP(JP).EQ.999)GO TO 27

      IDEPTH(JP+1)=LBITS(13,12,MASS(IC+5))
      ITEMP(JP+1)=LBITS(1,12,MASS(IC+5))
      IF(IDEPTH(JP+1).EQ.0.AND.ITEMP(JP+1).EQ.999)GO TO 26
      IC=IC+1
25    CONTINUE
      STOP 10
26    JP=JP+1
500   FORMAT(10(I5,I5))
27    CONTINUE
      ID=ID+IWD
      K=K+1
      GO TO 652
999   PRINT 1000,KP,K
1000  FORMAT(7H RECORD,I7,8H REPORTS,I3)
      GO TO 620
700   CONTINUE
      PRINT 900,K
900   FORMAT(15H TOTAL REPORTS= ,I10)
      STOP
      END
```

2.FOHIRS

Format in FNWC Technote #39 (p.23) may be used with the following recommendations:

a. not all soundings start at the surface

b. missing data filled by 7777_8 which is also equal to 20° C.

c. data frequently redundant with many, but not all, temperature/depth pairs repeated.

d. temperatures near 40°C appeared at the polar latitudes. The following reasoning and treatment are used:

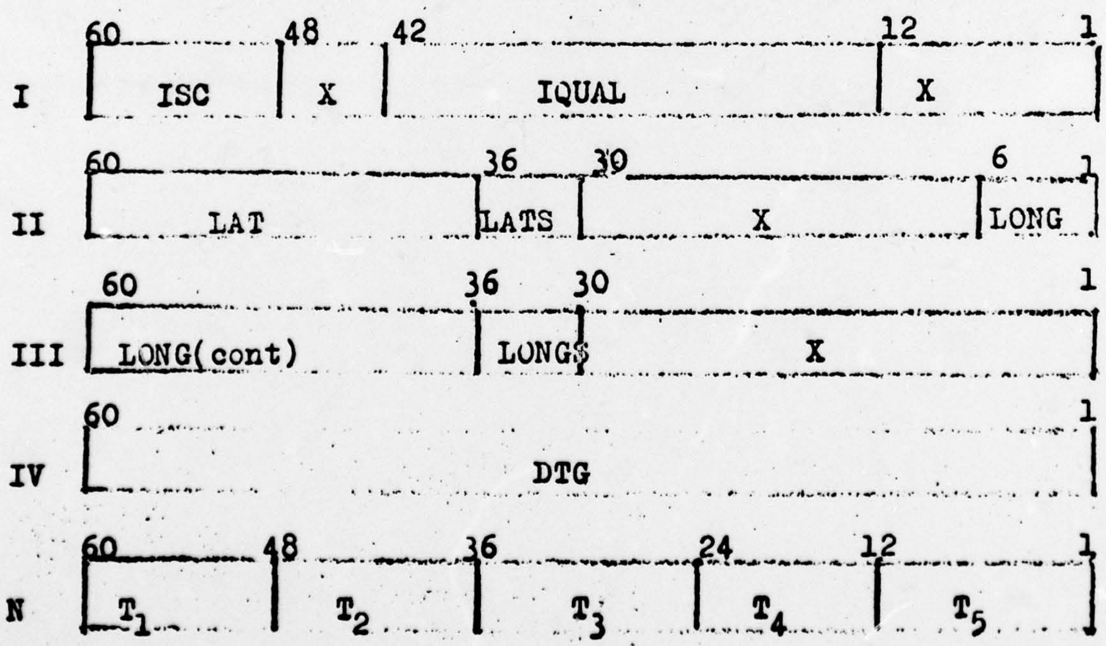
The packed data is (T-20)x100 packed into 12 bits. Temperature data read as 40 is packed (40-20)x100 $=2000_{10}$ or 3720_8. In the cases of the apparent incorrect temperatures near 40°C, the data is treated as though the sign bit were not retained and the negative compliment is used: negative compliment of $3720_8 = -4057_8$ or -2095_{10}. $-2095_{10} \div 100 + 20 = -.95°C$ which fits the geographic location.

APPENDIX C: Output Formats

There are two basic formats used in the project output:

1. All project tapes except the output of FIN:

The file contains the quadrants in the order NE,NW,SE,SW. Each quadrant contains records of two degree square data starting at 0,0 increasing longitude to 178 then incrementing latitude by two degrees and returning to 0 longitude , etc. to 88,178.
Each record contains all of the interpolated reports in the two degree square, record length is variable and as large as 7622 60-bit words.



Words I to IV are in 1604 BCD and can be read with one DECODE statement:

```
    DECODE(40,10,IWD(1))ISC,IQUAL,LAT,LATS,LONG,LONGS,ITIME
 10 FORMAT(A2,1X,A5,2X,I4,R1,4X,I5,R1,5X,I10)
```

Temperature values at the 19 standard levels start at word V. Each temperature value is (T+3)x10 and is stored in 12 bits. The final temperature is followed by 999 in 12 bits. The remainder of the word containing the 999 and the following word are zero filled. The next report starts in the next word, etc. to the end of the record.

ISC	source of report: XB,FO,4D
IQUAL	flag of report:11111,LAND, etc.(see text)
LAT	(latitude degrees and minutes)x100
LATS	sign of the latitude: N/S
LONG	(longitude degrees and minutes) x100
LONGS	sign of the longitude: E/W
DTG	date time group:YYMoMoDDHHMiMi

A subroutine to read in a record and unpack the reports in 24 word arrays on the 6500 follows.

```
      SUBROUTINE READIN(KT)
      DIMENSION KPT(24)
      COMMON/A/KEEP(8000)
      CALL ZILCH(KEEP,8000)
   60 BUFFER IN(1,1)(KEEP(1),KEEP(8000))
      IF(UNIT(1)) 80,70,65
   65 PRINT 66
   66 FORMAT(30X,*PARITY ERROR TAPE1*)
      GO TO 60
   70 KT=-10
      RETURN
   80 IEF=0
      LE=LENGTH(1)
      IA=1$KT=0
   85 IF(IA.GT.LE-4) RETURN
      IF(KT.GT.1300) RETURN
      KT=KT+1
      DO 90 K=1,4
      IB=IA-1+K
      KPT(K)=KEEP(IB)
   90 CONTINUE
      IAA=IA+4
      IAB=IA+19
      KR=5
      DO 100 KA=IAA,IAB
      DO 95 MA=1,5
      MV=(MA-1)*12
      KPT(KR)=LBYTX(49-MV,12,KEEP(KA))
      IF(KPT(KR).EQ.999) GO TO 120
      KR=KR+1
      IF(KR.EQ.24) GO TO 120
   95 CONTINUE
  100 CONTINUE
  120 KPT(KR)=999
      CALL WRITEC(KPT,(KT-1)*24,24)
      IA=KA+2
      GO TO 85
      END
```

2. Output of FIN:

The data is in the same geographical order as 1. above except that void two degree squares are included. Each record contains one two-degree square (later forms may have records consisting of many squares) and is 20 60-bit words long.

```
          60   56          42   36              21   15              1
 I        | MN | LAT        |LATS| LONG          |LONGS|      X       |

 II       60          48         36          24         12           1
 to       |     T     |    SD    |     M     |    MIN   |    MAX     |
 XX
```

MN	month (I2)
LAT	(see 1.) I4
LATS	(see 1.) in 6500 display code
LONG	(see 1.) I5
LONGS	(see 1.) in 6500 display code
T	total number of reports I4
SD	standard deviationx100
M	(mean+3)x100
MIN	(minimum+3)x100
MAX	(maximum+3)x10
X	zero fill

Words II to XX have the data for the 19 standard levels. Where total(T) is zero, the remainder of the word is zero filled.

APPENDIX D: Related Computer Programs

NAME	ORIGINATOR	PURPOSE
NDXBBC(1604)	Lewit/Dale	convert NODC BCD tapes to FNWC binary.
NDXBBN(1604)	Lewit	convert NODC binary to FNWC binary.
SORT(1604)	Dale	sorts data in FNWC binary by quadrant, one degree square, month, year, day, time.
DUPER(1604)	Dale	handles non-exact and exact duplicates.
MERGEO(1604)	Dale	merges two pre-sorted files into one.
ROUNDOUT(1604)	Dale	copy tapes and stop at predetermined two degree latitude increment.
REDU4D(1604)	Lewit/Dale	converts and packs 4D reports.
MESSY(1604)	Church	ident and find depth/temp pairs in Fohirs data.
DOESIT(1604)	Church	sort and check for duplicates FOHIRS.
MON2(6500)	Lewit	(see text)
SPOTXBT(6500)	Rabe/Lewit/ Perkins	read XBT reports.
FIND4D(6500)	Lewit	read, unpack packed 4D reports.
FINDFOH(6500)	Church	read FOHIRS reports.
MELD(6500)	Lewit	(see text)
IDENT(1604)	Lewit	print report heading from project tapes (option to print temperatures, option to print all data in specified 2° square).
QUALBT(6500)	Lewit	(see text)

NAME	ORIGINATOR	PURPOSE
COMPARE(6500)	Lewit	(see text)
REJECT(6500)	Lewit	(see text)
FIN(6500)	Lewit	(see text)
STACKOC(1604)	Lewit	stack individual records from FIN into larger records, all months on one tape.
BYMONTH(1604)	Lewit	sort output of MON2 into monthly tapes.
DUPID(1604)	Lewit	check for exact duplicates on project tapes.
STACK (1604)	Lewit	stack output of MON2
CORRECT(1604)	Lewit	correct an individual report on project tape.
IDENT(6500)	Lewit	print report headings for project tapes.
✓STATS(6500)	Lewit	compute statistics and print profile from individual reports for specified areas from project tapes.
BTSEA(6500)	Lewit	check XBT master for reports over land.